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Rural and Urban Populace's Disparity in Access to Infrastructural Facilities in Delta State, Nigeria

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Abstract

Unevenness in the distribution and availability of a number of efficient infrastructural utilities, which are all helpful to the socio-economic well-being of both countryside and urban populace, is a hallmark of development in third-world countries. This paper examined disparity in access to functional utilities by the rural and urban populace of southern Nigeria, with a particular focus on Delta State. The specific objective are to analyse the existing distributional patterns of selected infrastructures i.e., how these facilities are spatially distributed across rural and urban areas as well as identifying the existing disparities; evaluate the impact of these facilities on rural-urban development in Delta State by reviewing how the presence or absence of these facilities influences economic activities, quality of life, and overall development in different regions; highlight the strategic development frameworks available for addressing infrastructural deficit; discuss the policy implications of the findings and make recommendations based on the findings of the research. The research methodology employed in this study is that of content analysis involving an extensive review of textual materials from secondary sources. Based on analysis of the geographical distribution of the seven infrastructure treated, this research found notable differences between urban and rural regions and the populace's access to efficient infrastructures with serious implications for their quality of life and development necessities of both zones. The research recommends strategic development frameworks and policies that can address the mal-distribution of basic facilities between the rural and urban regions.

Keywords

Rural-Populace, Urban-Populace, Infrastructural-Disparity, Infrastructural-Access, Asaba, Delta State

1. Introduction

The extent to which the population of a given country can influence development positively depends largely on its size and quality. Nigeria as a nation and the Delta state by extension already have what it takes in terms of absolute population size, even its rural and urban distribution. This has been achieved through consistently high birth and death rates. The current birth rate in Nigeria is 34 per 1000 per annum, while the Death rate, which is conspicuously lower than the birth rate, is currently placed at 19 per 1000 per annum (Sajini, 2022). This is indicative of adequate human resources, which are needed to engender further development. However, the quality component of the development capacity of the population can only be achieved when the populace has access to utilitarian infrastructural facilities that enhance the quality of life. These include, but are not limited to, educational, medical, energy, transportation, water resource, waste management, and recreational and tourism facilities. Successive governments have striven to make these provisions to boost the quality of life of their subjects through various strategic development frameworks. However, the efforts are usually marred by the inequality in the location and distribution of the facilities provided, leading to disparity in accessibility by the rural and urban populace to these all-important facilities (Henriques & Brilha, 2017; Chanieabate et al., 2023).

Although both rural and urban development depend on serviceable amenities, as the provision of these fundamental services makes for increased living standards at the individual family level, on the one hand, and encourages sustainable development at the macro level. Variation exists in their pattern and experience of allocation and distribution of these basic facilities between the developed and the less developed regions of the world (De Siqueira, 2012).In the more developed countries, where there rarely exists an imbalance in the availability of infrastructural facilities between the countryside and the towns and cities, a fairly uniform standard of living becomes the norm across the board. Whereas, in most developing countries, Nigeria inclusive, experience has shown that lop-sidedness is evident in the distribution of facilities that make life convenient. These differentials in the location of these facilities began during the colonial era, when the colonial master developed administrative towns to make governance of territories convenient for the colonial administrator. These towns were laced with some basic infrastructure coupled with their locational advantages. This inequality in the location of basic infrastructure becomes one of the reasons rural-urban migrations are the most predominant form of migration in Nigeria and in most third-world countries (Onokerhoraye, 1995) (this situation is properly described in **Figure 1**). The

rural-urban migration is triggered as the rural population has no equal privilege with the city dwellers with respect to access to basic serviceable facilities (Sajini, 2024).

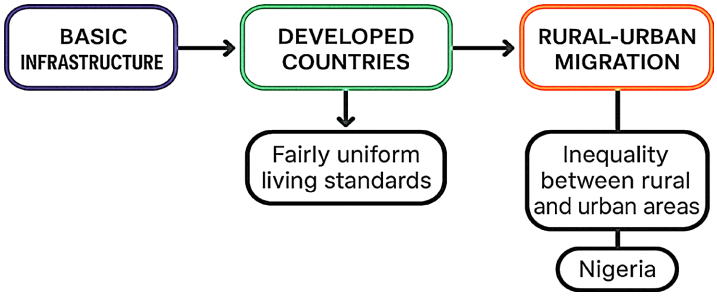


Figure 1. Authors' conceptualization (2024).

Delta State, with a grid reference address of latitudes 5˚00'N and 6˚00'N and longitudes 5˚00'E and 6˚00'E, is located within the South-south geopolitical zone in Nigeria. The state has a total population figure of 5,636,100 as of 2022 (https://www.citypopulation.d/en/nigeria) that is predominantly youthful (Sajini, 2007) is spatially distributed between the rural and urban components in the ratio of 60% and 40% (3:2) over a land cover area of approximately 17,698 m^2.

Research has shown that useful facilities have the challenge of distribution in most developing countries, with Delta State in Nigeria not being an exception. It is against the backdrop of spatial inequality that this research article intends to examine the disparity in access to infrastructure by the rural and urban populace, with the specific objective being to:

1) Analyze the existing distribution patterns of selected infrastructures such as educational, medical, energy, transportation, recreational, tourism, water, and waste management facilities in Delta State. This involves examining how these facilities are spatially distributed across rural and urban areas and identifying any existing disparities.

2) Evaluate the impact of these facilities on development in Delta State. The study will assess how the presence or absence of these facilities influences economic activities, quality of life, and overall development in different regions.

3) Highlight the strategic development frameworks available for addressing the infrastructural deficit.

4) Discuss the policy implications of the findings of this theoretical review, and

5) Make recommendations based on the findings of the research.

2. Theoretical/Conceptual Framework

The Central Place Theory

This research work on rural and urban populace's disparity in access to infrastructural facilities hinges on a spatial model of interaction called the Central Place Theory. As far back as 1933, Walter Christaller propounded the Central Place Theory (Barnes, 2015) (see **Figure 2**).

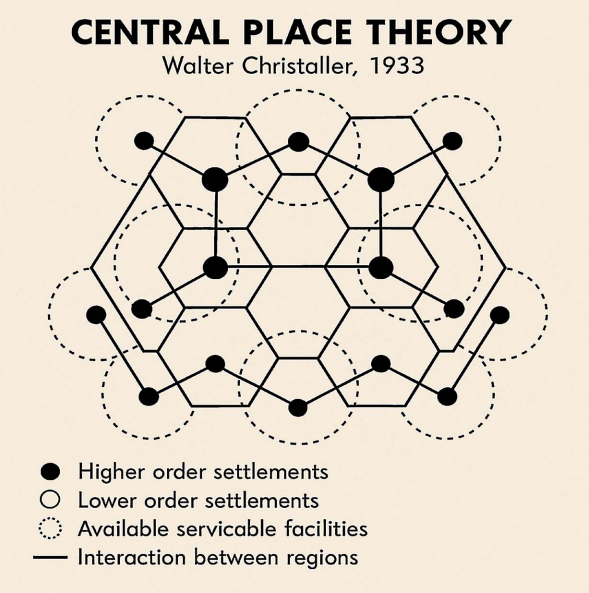


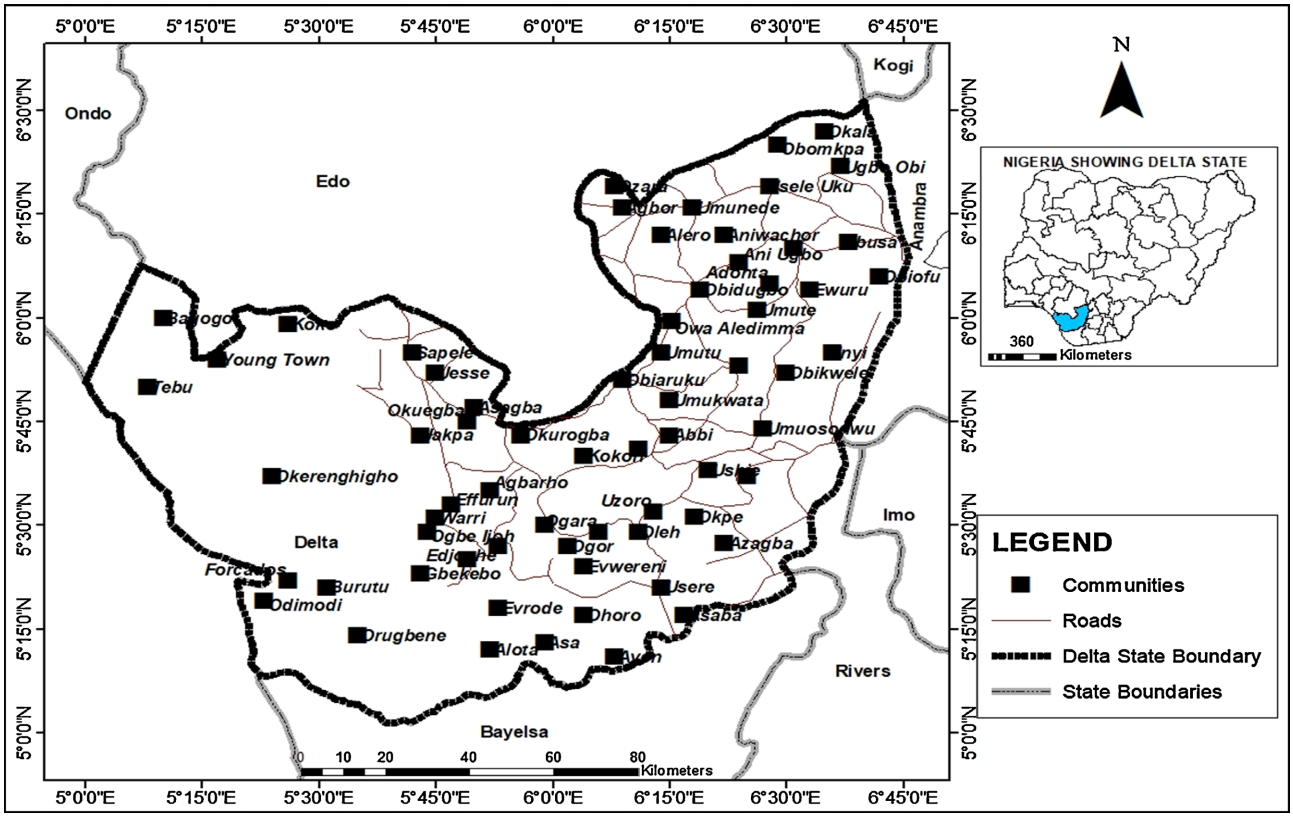
Figure 2. Modified Walter Christaller's 1933 central place theory.

The theory basically addressed settlement sizes and the interaction between them as it relates to population movement and that of goods and services in Germany via hexagonal patterns and networks that are realized when setting up the arrangements of different orders of settlements with varying population in higher order settlements alongside the available serviceable facilities (Wikman & Mohall, 2022). This theory is most relevant to this research because it captures the fundamental nature of locational analysis, highlights the economic relationships of cities and smaller settlements and the spatial interaction between the regions. This spatial model has been applied in settlement planning, transportation planning, tourism planning and general infrastructure planning (Xia et al., 2023; Sajini, 2007, 2021, 2022, 2024) based on population concentration and the level of demand for them, thus enhancing accessibility.

3. Materials and Methods

3.1. Study Area

The study was conducted in Delta State, Nigeria, as illustrated in **Figure 3**. Delta State lies within the coastal belt of the country Nigeria on Latitudes: 5.00˚N to 6.30˚N and Longitudes: 5.00˚E to 6.45˚E (Ozabor et al., 2023; Ozabor & Ajukwu, 2023a). The area is characterized by the Af classification under Köppen's climate system, which denotes a wet equatorial climate. The region experiences a distinct seasonal pattern driven by the interaction of the continental tropical (cT) and maritime tropical (mT) air masses, resulting in marked wet and dry seasons. Annual rainfall ranges between 2105 mm and 2435 mm, with mean temperatures fluctuating between 27˚C and 29˚C (Famous, 2024). Beyond its climatic conditions, Delta State stands as one of Nigeria's leading oil-producing regions, a factor that contributes significantly to both its economic relevance and its environmental



Source: Adapted from the Delta State Ministry of Lands, Surveys and Urban Development.

Figure 3. Delta State showing the major communities.

degradation (Famous et al., 2023). The unchecked oil extraction activities and frequent sabotage incidents have led to severe soil contamination, with pollutants seeping into the groundwater through percolation. In rural areas especially, residents rely heavily on untreated groundwater sources for drinking, under the false assumption of safety. This has led to numerous public health crises due to consumption of contaminated water.

The rapid urbanization of Delta State, particularly since the 1980s, has further intensified pressure on existing infrastructure. Comparing the 1991 and 2006 census figures, the state's population nearly doubled in just 15 years, driven largely by oil-related economic opportunities and fertile agricultural lands. However, this surge in population has not been matched by proportional improvements in infrastructure, particularly in potable water supply and other services deliveries (Ozabor et al., 2025). While urban areas attract more investment and attention, many rural communities remain underserved. The government's inability to meet growing rural development demands has opened the door to private sector intervention. Unfortunately, due to inadequate regulation and oversight, these operations often produce substandard water, exacerbating health risks for rural and low-income urban dwellers. This situation starkly highlights the deepening disparity between rural and urban populations in accessing basic infrastructural facilities such as clean water.

3.2. Methodology

A descriptive approach was adopted for this largely qualitative research, with data for the logical evaluation of the disparity in Rural and Urban populace's assess to efficient infrastructures sourced primarily from secondary sources (see Figure 4). A systematic and extensive review of textual materials was carried out and the derived facts were analysed via the method of Content analysis. The secondary sources in question include sources like: academic journals, books, government publications and internet materials. A systematic search strategy was employed, and databases such as JSTOR, Scopus and Google Scholar were consulted using keywords like "urban-rural infrastructure disparity," "Central Place Theory," "service distribution in Nigeria," and "Delta State facilities". The period covered for publications was from 1998 to 2024. The choice of this period was a result of the third republic of Nigeria, which happened in the year 1999 (democratic era). The content analysis used involved open coding to identify recurring themes, followed by axial coding to group the data under seven major facility types. This ensured consistency and reproducibility in categorization.

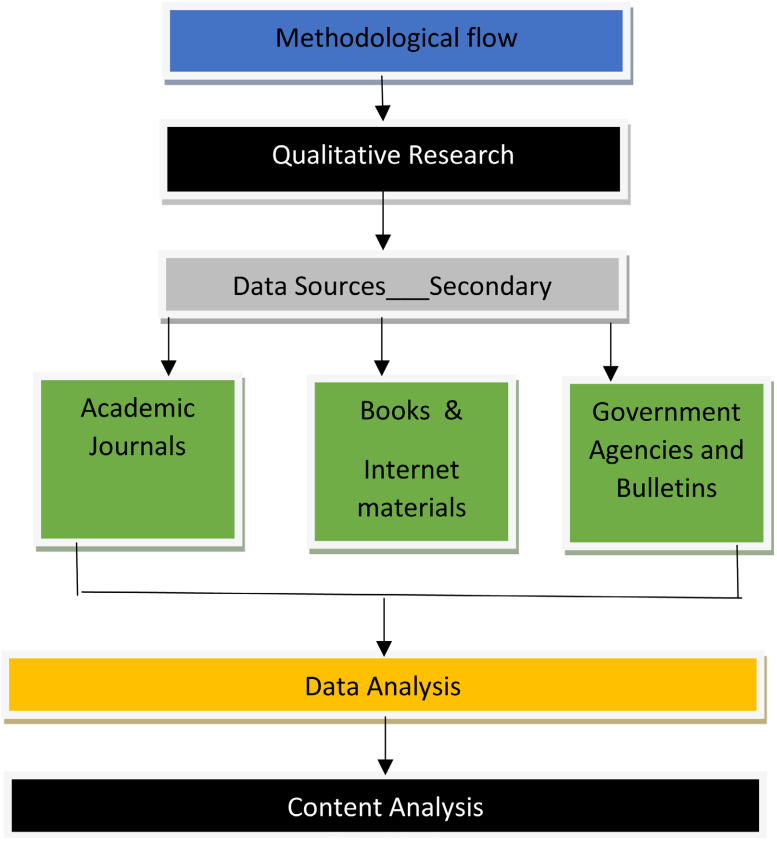


Figure 4. Methodological flow for the study.

However, there are a few limitations to this study. One of the limitations is its reliance on secondary data sources, which may not have captured recent infrastructural developments or disparities at micro-spatial levels. Similarly, the study

is unable to account for undocumented, informal or community-based service alternatives that exist in rural areas. Additionally, the analysis simply assumed uniform access to facilities in the urban centers, and by implication overlooked intra-urban inequalities that may affect actual service distribution and accessibility.

4. Findings

4.1. Educational Facilities

4.1.1. Overview of Educational Facilities in Delta State

The southern Nigerian state of Delta State is home to a wide range of educational facilities, from elementary schools to universities. The state government, in collaboration with the private sector, has made substantial investments in the field of education. Notable establishments in the state include Delta State University in Abraka, University of Delta, Agbor, Delta State University of Science and Technology Ozoro, Dennis Osadebay University Anwai-Asaba, Delta State Maritime University Okerenkoko, Federal University of Petroleum Resources in Effurun, Western Delta University Oghara, and several polytechnics and colleges of education. These establishments serve the educational needs of both urban and rural populations, though quality and accessibility differences are common between these areas (Udenigwe et al., 2022).

4.1.2. Impact of Educational Facilities on Rural-Urban Development

One of the most important factors in promoting rural-urban growth is educational institutions. Having access to high-quality education is essential for the development of human capital in rural regions, which in turn promotes economic growth and lowers poverty. Through education, people may gain knowledge and skills that improve their employability and productivity, which boosts the local economy (De Siqueira, 2012). Educational institutions draw companies and industries looking for trained labour supply, which boosts the local economy and encourages urban expansion.

Education also lessens inequality and fosters social inclusion by giving everyone, regardless of financial status, access to opportunities. By guaranteeing that rural residents have access to the same calibre of education as their urban counterparts, well-distributed educational facilities can lessen the gap between rural and urban areas and discourage migration from one to the other caused by educational inequalities (Henriques & Brilha, 2017).

4.1.3. Spatial Distribution and Accessibility of Educational Facilities

There are notable differences between urban and rural regions in Delta State based on the accessibility and geographical distribution of educational institutions. There is a greater concentration of educational institutions in urban areas like Asaba and Warri, from well-equipped primary schools to postsecondary institutions. Higher educational standards and results are attained in these locations as a consequence of improved infrastructure, greater resources, and competent instructors (Ozor et al., 2024).

On the other hand, poor infrastructure, a shortage of teachers, see Table 1, and a lack of educational resources are common problems in rural regions. Basic facilities like water, power, and instructional materials may be lacking in these schools, which hinders learning. Another significant problem is school accessibility, as pupils in rural regions sometimes have to travel great distances for school, which lowers attendance rates and educational achievement (Nwokoye et al., 2020; Sajini & Ijeh, 2021).

Table 1. Disparity indicator analysis for education per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Financial Budgeting	₦120,000	₦400,000	0.3
Human Resources	4 personnel	12 personnel	0.33
Infrastructure	3 functional units	10 functional units	0.3

Source: Nigerian Bureau of Statistics (2024).

4.1.4. Overview of Medical Facilities in Delta State

Primary healthcare centres, general hospitals, specialist hospitals, Federal Medical centre and private clinics are all part of Delta State's healthcare system, which is made up of both public and private healthcare institutions. The Federal Medical Centre in Asaba, the Delta State University Teaching Hospital in Oghara, and other general hospitals dispersed throughout the state's local government areas are important public healthcare institutions. The private sector makes a substantial contribution to healthcare, with many hospitals and clinics offering necessary services, especially in metropolitan regions. Notwithstanding these assets, the healthcare system still confronts issues that have an impact on service delivery, including poor infrastructure, a lack of medical professionals, and an unequal distribution of facilities (Omorogiuwa & Aibangbee, 2017).

4.1.5. Influence of Medical Facilities on Population Health and Mobility

When it comes to population health outcomes and patterns of mobility, medical facilities are extremely important. Improving overall life expectancy, controlling chronic illnesses, and lowering morbidity and death rates all depend on having access to high-quality healthcare services. Preventive care, prompt diagnosis, and efficient treatment are crucial for preserving public health, and they are supported by an efficient healthcare infrastructure (World Health Organization & World Bank Group, 2018; Oso et al., 2025).

Lack of access to healthcare services in rural locations frequently raises health risks and produces worse health results. Long travel times between residents and healthcare providers might exacerbate illness problems and postpone treatment. People and families who migrate from rural to urban regions in quest of better healthcare are impacted by this lack of access. On the other hand, because of increased access to healthcare services, metropolitan areas—which have a larger

concentration of medical facilities—generally have better health results (National Population Commission, 2019).

4.1.6. Spatial Analysis of Healthcare Accessibility

There are notable differences between urban and rural regions in Delta State based on the geographical distribution of healthcare services. There is a robust network of hospitals, clinics, and specialized healthcare providers in urban areas, including Asaba, Warri, and Sapele. Higher accessibility and higher-quality treatment are the results of these locations' improved infrastructure, increased numbers of medical professionals, and greater availability of healthcare services (Omorogiuwa & Aibangbee, 2017).

Healthcare facilities are few and sometimes devoid of both competent staff and necessary services in rural locations (see **Table 2**). The most prevalent kind of facilities in these locations are primary healthcare centres; however, they usually struggle with low infrastructure, low budget, and a shortage of medical supplies. Significant health disparities occur from this geographic variation in healthcare access, with rural communities encountering greater obstacles to receiving essential medical treatment (Okafor et al., 2022).

These discrepancies may be seen and locations with severe healthcare needs can be identified by spatial analysis utilizing GIS technology. Policymakers can more efficiently allocate resources to disadvantaged regions and gain a better understanding of service supply gaps by mapping the locations of healthcare institutions and examining their accessibility (Adeleye et al., 2024).

Table 2. Disparity indicator analysis for medical facilities per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Medical Facilities	0.8 hospitals	3.5 hospitals	0.23
Staffing Ratios	1:1800	0.458333333	0.33
Equipment Availability	35% of standard	90% of standard	0.39
Facility Capacity	40 beds	150 beds	0.27

Source: Nigerian Bureau of Statistics (2024).

4.1.7. Energy Facilities

Status of Energy and Power Infrastructure in Delta State

Nigeria's Delta State, an important oil-producing area, has a sizable energy and electricity infrastructure. The state is home to a number of power facilities, notably the Okpai Power Plant run by the Nigerian Agip Oil Company and the Delta Power Station in Ughelli, one of Nigeria's largest gas-fired power plants. Notwithstanding these assets, the state still has difficulties securing a steady and dependable supply of electricity. Frequent power outages and unstable energy distribution are caused by problems including poor maintenance, transmission losses, and a lack of infrastructure investment (Ojo & Amassoma, 2021).

4.1.8. Role of Energy Facilities in Economic and Social Development

Nigeria's Delta State, an important oil-producing area, has a sizable energy and electricity infrastructure. The state is home to a number of power facilities, notably the Okpai Power Plant run by the Nigerian Agip Oil Company and the Delta Power Station in Ughelli, one of Nigeria's largest gas-fired power plants. Notwithstanding these assets, the state still has difficulties securing a steady and dependable supply of electricity. Frequent power outages and unstable energy distribution are caused by problems including poor maintenance, transmission losses, and a lack of infrastructure investment (Amadi, 2015; Salman et al., 2023).

Socially, having access to electricity improves quality of life because it powers basic services like water supply, healthcare, and education. Better services provided by electrified schools and health centres result in higher health standards and better educational outcomes. Reliable energy access makes modern household amenities possible, improving living conditions and cutting down on time spent on labour-intensive tasks like fetching water or cooking with traditional fuels (Newell et al., 2019).

4.1.9. Spatial Distribution of Power Facilities

In Delta State, power facilities are distributed unevenly, with urban areas having greater access to electricity than rural areas. More extensive electrical infrastructure, including distribution networks, transmission lines, and substations, is present in urban areas like Asaba, Warri, and Sapele, guaranteeing a more steady supply of energy. Conversely, rural regions generally suffer from poor infrastructure (see **Table 3**), resulting in frequent power outages and restricted access to energy (Okoye & Achakpa, 2007; Onyekachi, 2024).

Table 3. Disparity indicator analysis for Energy Facilities per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Energy Facilities	200 kWh	950 kWh	0.21
Total Energy Consumption	220 kWh	1200 kWh	0.18
Specific Energy Consumption	0.2 kWh/person	1.2 kWh/person	0.17
Consumption by End Use	3 uses (mostly lighting)	8 uses (including HVAC)	0.38

Source: Nigerian Bureau of Statistics (2024).

Socioeconomic disparities are made worse by the gap in energy availability between rural and urban areas; because of unstable power supplies, rural populations have more difficulties in day-to-day living and economic pursuits. Rural electrification initiatives that seek to connect underserved regions to the grid and encourage the use of renewable energy sources like solar and wind power are two ways that efforts are being made to enhance the geographical distribution of power facilities (Nwankwo, 2018).

4.1.10. Overview of Transportation Infrastructure in Delta State

The transportation network in Delta State is varied and consists of air, sea, rail, and road networks. The state has the largest road network, with major routes like the Warri-Sapele Road and the East-West Road linking important cities and enabling travel both within the state and to neighbouring areas. Air connection is offered by the Osubi Airport in Warri and the Asaba International Airport, which handles both passenger and cargo traffic. Delta State also has extensive water transport facilities due to its numerous rivers and closeness to the Atlantic Ocean, with ports at Warri and Koko supporting the marine industry. But even with these advantages, there are still issues with the transportation system, especially in rural regions where there is inadequate investment, traffic, and poor maintenance (Onokala & Olajide, 2020).

4.1.11. Impact of Transportation on Connectivity and Economic Growth

The development of transportation infrastructure is essential for improving connectivity and stimulating the economy. The movement of people, products, and services is made easier by efficient transportation networks, which lower transaction costs and increase output. Better transportation options (road, rail, air, and water) can greatly boost trade and commerce in Delta State, especially in the oil and gas industry, which is a key driver of the state's economy. In addition to facilitating the efficient distribution of agricultural goods and attracting investment and tourists, improved transportation linkages can help advance general economic growth (Onah, 2023).

Socially, transportation infrastructure improves access to essential services such as healthcare, education, and employment, enhancing the quality of life. Reliable transport systems reduce travel time and costs, making it easier for residents to access job opportunities and public services. This connectivity is particularly important for rural areas, where poor transport links can lead to isolation and hinder socio-economic development (Aderibigbe & Gumbo, 2022).

4.1.12. Spatial Mapping of Transportation Networks

Disparities between urban and rural regions are evident in Delta State's transportation networks' geographical distribution (see **Table 4**). Urban hubs with good road, air, and water transportation connections, like Asaba, Warri, and Sapele, enable effective mobility and economic activity. The aforementioned places see increased economic vitality and connectivity due to regular flights, well-maintained roads, and busy ports (Oviedo & Sabogal, 2020).

On the other hand, inadequate road maintenance, a lack of public transit choices, and inadequate water transportation infrastructure are common problems in rural regions. This geographical inequality makes it more difficult for rural areas to do business, inhibits market access, and restricts the movement of people and products. GIS-based spatial mapping can assist in locating gaps in the transportation system, allowing for focused actions to enhance connectivity and promote rural development (Aderamo, 2010).

Table 4. Disparity indicator analysis for Transportation Facilities per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Vehicle/Passenger Throughput	250 trips	2000 trips	0.13
Load Factor	50%	85%	0.59
Network Density	4 km/1000 people	12 km/1000 people	0.33
Capacity Utilization Rate	45%	88%	0.51

Source: Nigerian Bureau of Statistics (2024).

4.1.13. Status of Recreational and Tourism Facilities in Delta State

Delta State boasts an array of leisure and tourism amenities that are a fitting reflection of its abundant natural resources and cultural legacy. Important points of interest are the Kwale Game Reserve, the River Ethiope (which is said to be the deepest interior river in Africa) Otuogu Beach, and historical monuments like the Nana Living History Museum. In addition, cities like Asaba and Warri provide contemporary leisure facilities including movie theatres, retail shops, parks, and sports complexes. Unfortunately, issues including low finance, subpar infrastructure, and insufficient marketing frequently impede the creation and upkeep of these facilities, limiting their ability to draw visitors and provide good local resident service (Ijeomah et al., 2019).

4.1.14. Contribution of Recreation and Tourism to Rural-Urban Development

Due to their ability to generate income, create employment, and promote community involvement, tourism and recreation play a major role in rural-urban development. The tourism industry boosts regional economies by drawing travellers who spend money on lodging, dining, travel, and entertainment. This expenditure infusion helps companies and may spark the creation of new ones, boosting economic growth (Citaristi, 2022).

By offering alternate sources of income, tourism can lessen reliance on traditional fishing and farming in rural regions. Additionally, it can support the preservation of places of natural and cultural significance, which improves environmental sustainability. Furthermore, recreational facilities enhance the standard of living for locals by offering areas for relaxation and socializing, both of which are crucial for the health of the community (Okoli & Alumona, 2020).

4.1.15. Spatial Analysis of Tourism Sites and Recreation Centres

With a larger prevalence in metropolitan regions and popular tourist destinations, Delta State's tourism and leisure venues are unevenly distributed in space. Modern recreational amenities, like as parks, sports complexes, and entertainment centres, are well-equipped in urban areas like Asaba, Warri, and Sapele, and they

serve both locals and visitors. However, despite their potential for tourism, a lot of rural places lack the necessary infrastructure and funding, which reduces their allure and accessibility (see Table 5) (Ijeomah et al., 2019).

The spatial distribution of tourist and recreational amenities may be mapped using Geographic Information Systems (GIS), which can be used to pinpoint locations with strong development potential as well as any gaps. Succinctly, in guaranteeing a more equitable allocation of resources and fostering regional development, this spatial analysis can assist in strategic planning and investment decisions (Liang, 2024; Ozabor & Ajukwu, 2023b).

Table 5. Disparity indicator analysis for Recreation and Tourism Facilities per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Recreation and Tourism Facilities			
Provision of Tourism Facilities	1 per 1000	6 per 1000	0.17

Source: Nigerian Bureau of Statistics (2024).

4.1.16. Overview of Water Resource Management in Delta State

Nigeria's Delta State, which is a part of the Niger Delta, has an abundance of water resources, such as rivers, creeks, and wetlands. The River Niger, River Ethiope, River Forcados, and a few smaller rivers and streams make up the state's main bodies of water. Numerous activities, including household usage, irrigation, fishing, transportation, and industrial operations, depend on these water supplies. However, there are several obstacles to the management of these resources, including pollution, wasteful water usage, poor infrastructure, and the effects of climate change (Aniah et al., 2019).

Delta State's water management includes a number of parties, including the state government, local governments, and businesses in the private sector. The state government is in charge of developing and maintaining water infrastructure, regulating water consumption, and putting policies intended for sustainable water management into action through organizations like the Delta State Ministry of Water Resources. Notwithstanding these initiatives, problems with maintaining water infrastructure, protecting water quality, and distributing water fairly continue to exist (Erah & Akujieze, 2002).

4.1.17. Importance of Water Facilities for Sustainable Development

Water facilities are vital to sustainable development because they provide basic services that maintain economic activity, livelihoods, and health. Sanitation, cleanliness, and home usage all depend on having access to clean, dependable water, all of which are vital for public health. Water resources are vital to agriculture because they support cattle, aquaculture, irrigation, and rural communities. Water

is essential to industrial operations for a number of processes, making it a crucial component of economic output (Sheriff et al., 2019; Oweibia et al., 2024).

Additionally, by preserving wetlands and other natural ecosystems that offer biodiversity, flood management, and climate regulation, water infrastructure promotes ecosystem services. In order to guarantee the long-term availability and quality of water resources, sustainable water management techniques (such as effective irrigation systems, pollution control measures, and the preservation of water bodies) are essential. These actions support both the general sustainability of the ecosystem and public health (Gleick, 2000).

4.1.18. Spatial Distribution and Management of Water Resources

The topography and hydrology of Delta State affect the geographical distribution of its water resources. Water resources are plentiful in the state's centre and southern regions, which are distinguished by a network of rivers and streams. On the other hand, seasonal variations in water supply can occur in the northern regions. To guarantee that every region has sufficient access to water, this unequal distribution calls for efficient management techniques (Adeleye et al., 2014).

Geographic Information Systems (GIS) may be used for spatial analysis to assist in identifying and prioritizing locations with inadequate water facilities. Mapping the locations of irrigation systems, water treatment facilities, and boreholes, for example, can help identify infrastructure shortages and direct resource allocation. In order to be considered effective, management must also control water usage, monitor water quality, and put policies that support sustainable practices into effect. Involving the community in water management is essential because local expertise and engagement may improve interventions' efficacy and guarantee that they satisfy the demands of the populace (Jacobs et al., 2016).

4.1.19. Status of Waste Management Infrastructure in Delta State

Like many other Nigerian areas, Delta State has substantial infrastructural difficulties related to garbage management. The state's fast population expansion and urbanization have increased trash generation, surpassing the capability of the current waste management systems. A combination of official and informal systems, with differing levels of coverage and efficiency, makes up the infrastructure. The Delta State Garbage Management Board is in charge of collecting, transporting, and disposing of municipal solid garbage in relation to formal waste management. But the board frequently faces challenges related to a lack of resources, a lack of tools, and a shortage of personnel (Agunwamba, 1998; Ozabor et al., 2024a).

Although they are not well-regulated or supported, informal waste management techniques, such as rubbish pickup and recycling by informal workers, are essential to waste recovery and recycling. Furthermore, the lack of infrastructure for waste treatment and recycling has resulted in a strong reliance on open landfills and dumpsites, many of which are poorly managed and represent serious threats to the environment and public health (Nabegu, 2010).

4.1.20. Impact of Waste Management on Environmental and Public Health

Environmental and public health protection depend on efficient waste management. Inadequate waste management techniques in Delta State have resulted in serious environmental deterioration, including contaminated soil and water, air pollution from burning garbage, and an increase in the number of illegal dumpsites. These problems harm nearby ecosystems, contaminate supplies of drinking water, and aid in the spread of illness (Ozabor & Obaro, 2016).

In highly populated metropolitan areas, where inappropriate waste disposal can contribute to the spread of vector-borne illnesses like cholera and malaria, the effects on public health are especially severe. Children and communities with low incomes are particularly susceptible to these health hazards. In order to lessen these effects and provide a healthy living environment, proper waste management techniques are crucial. These practices include the segregation of trash at the source, frequent collection, and safe disposal or recycling (Adewumi et al., 2005).

4.1.21. Spatial Analysis of Waste Management Systems

There are notable differences between urban and rural regions in Delta State based on the geographical distribution of waste management infrastructure. More advanced waste management systems, including garbage collection services and designated dump sites, are found in urban areas like Warri, Asaba, and Sapele. On the other hand, informal disposal techniques, including open burning and dumping in unapproved places, are frequently used in rural regions due to a lack of official waste management infrastructure (see **Table 6**) (Nabegu, 2010).

Geographic Information Systems (GIS) may be used for spatial analysis to prioritize regions for intervention and find gaps in the waste management infrastructure. Mapping the locations of recycling centers, landfills, and dumpsites, for example, can identify underserved regions and direct resource allocation. Furthermore, garbage collection routes may be optimized with GIS, waste transport efficiency can be increased, and operating expenses can be decreased (Agunwamba, 1998).

Table 6. Disparity indicator analysis for Waste Management Facilities per 1000 persons in Delta State.

Indicator	Rural (per 1000 people)	Urban (per 1000 people)	Disparity Factor (Rural ÷ Urban)
Per Capita Waste Generation	0.35 kg/day	0.65 kg/day	0.54
Waste Generation Rate	350 kg/day	650 kg/day	0.54
Waste Composition	Mostly organic	Mixed with industrial	—
Collection Coverage	18%	82%	0.22

Source: Nigerian Bureau of Statistics (2024).

5. Synthesis of Findings from Facility Analysis

The thorough examination of Delta State's operational facilities (which include

those related to education, healthcare, energy and electricity, transportation, leisure and tourism, water resources, and waste management) shows notable differences in the infrastructure development of rural and urban regions. In Delta State, urban areas often have more established and stronger infrastructures and easier access to these amenities. On the other hand, problems that impede growth and exacerbate regional disparities are common in rural regions.

5.1. Facilities for Education

Compared to rural regions, urban places like Asaba and Warri have more schools, greater student-to-teacher ratios, and superior educational resources. This inequality feeds the cycle of poverty and underdevelopment by influencing educational achievements and limiting chances for young people living in rural areas (Olaniyan & Okemakinde, 2008).

5.2. Medical Facilities

Metropolitan regions have a greater concentration of healthcare professionals and better-equipped hospitals. Rural regions sometimes rely on fewer, underequipped institutions, resulting in worse health outcomes and limited access to required medical services (World Health Organization & World Bank Group, 2018).

5.3. Energy/Power Facilities

While rural areas lack access to alternative energy sources and frequently face power outages, urban areas enjoy the advantages of a more comprehensive and dependable electricity infrastructure. The quality of life and economic activity in rural areas are negatively impacted by this inequality (Nnaji, 2015).

5.4. Transportation Facilities

Urban areas facilitate greater connection and economic activity since they have more established road networks and transit services. However, bad road conditions and few transit choices in rural areas isolate people and limit their access to services and markets (Oyesiku, 2002).

5.5. Recreation and Tourism Facilities

There are more recreational and tourism amenities in urban areas, which draw tourists and boost the local economy. The absence of infrastructure in rural areas prevents them from making use of their unrealized tourist potential, which limits their ability to diversify economically (Sharpley, 2002).

5.6. Water Resource Facilities

While rural communities deal with issues related to water quality and accessibility, urban areas often have better-managed infrastructure and water supplies. For rural communities' public health and agricultural output, effective water management is essential (Ushurhe et al., 2024).

5.7. Waste Management Facilities

While rural regions frequently lack official trash disposal and recycling facilities, urban centres have more structured waste management systems. This difference can pose health and environmental dangers, as well as contribute to environmental deterioration (Agunwamba, 1998).

Generally, the observed urban clustering of facilities in Delta State critically indicates the settlement hierarchy as proposed by the Central Place Theory. In this regard, the higher-order settlements like Asaba and Warri serve as dominant urban centres that provide a wider range of specialized services to the surrounding lower-order areas. Accordingly, the theory assumes that central places are spatially organized to provide goods and services to a hinterland, and as settlements increase in size and importance, they offer more advanced and diverse facilities. The concentration of educational institutions, better healthcare infrastructure, reliable energy and transport systems, recreational and tourism facilities, efficient water resource management, and formal waste disposal mechanisms in urban areas exemplifies their function as high-order central places. Conversely, the lack of such facilities in rural areas aligns with their status as low-order settlements that depend on central places for essential services. This uneven spatial distribution reinforces existing socio-economic disparities, as the urban dominance in service provision both reflects and perpetuates the urban-rural divide. There is therefore a need to bridge this gap to help decongest the cities, which can make room for effective development.

6. Comparative Analysis of Urban and Rural Facility Distribution

There are notable disparities that affect the dynamics of rural-urban development in Delta State when comparing the distribution of facilities between urban and rural regions. Higher living standards and more economic prospects are a result of urban regions' superior energy, waste management, recreational, medical, transportation, and water resource infrastructure, in addition to the demographic advantage of denser population concentration, which enhances socio-economic development (Sajini, 2021). Rural depopulation and underdevelopment are made worse by the movement that occurs from rural regions to urban centres due to the concentration of infrastructure there (Mihai, 2016).

On the other hand, poor infrastructure hinders the development of rural communities and prolongs poverty. Inadequate healthcare facilities have an impact on population health and productivity; unstable electricity supplies impede economic activity; inadequate transportation networks segregate communities; and a lack of educational facilities restricts the development of human capital. Furthermore, inadequate infrastructure for waste management and water resources creates threats to the environment and public health, while inadequate recreational and tourism facilities result in lost chances for economic diversification.

Improving rural infrastructure through targeted policies and investments is

necessary to address these discrepancies. Investing in water and waste management systems, building transportation networks, improving educational and healthcare facilities, and increasing dependable electricity supplies are all crucial first steps. In addition, encouraging rural leisure and tourism can aid in decreasing regional disparities and diversifying rural economies (World Health Organization & World Bank Group, 2018).

7. Strategic Development Frameworks

The following strategic development frameworks provide direction for resolving the infrastructural gaps found in Delta State:

1) National Integrated Infrastructure Master Plan (NIIMP): Nigeria's long-term infrastructure development objectives are outlined in the NIIMP, which focuses on areas including transportation, electricity, water, and sanitation. Prioritizing rural infrastructure projects, the strategy highlights the need for balanced regional development (Thompson & Rita, 2016).

2) Sustainable Development Goals (SDGs): With particular objectives for infrastructure, education, health, water and sanitation, and clean energy, the SDGs offer a worldwide framework for sustainable development. To achieve comprehensive and sustainable progress, Delta State's development initiatives must be in line with these objectives (Connor, 2015).

3) Delta State Economic and Social Development Plan: The development of infrastructure, social inclusion, and economic diversification are the main objectives of this state-specific framework. In order to promote balanced development, it describes methods for enhancing access to electricity, transportation, healthcare, education, and other necessities in both urban and rural communities (Ejumudo & Ejumudo, 2020).

4) Nigeria Vision 20:2020: By 2020, this national strategy seeks to place Nigeria's economy in the top 20 in the world through infrastructure development and economic diversification. It emphasizes how critical it is to resolve regional disparities and support rural development that is sustainable (National Population Commission, 2019; Okafor & Obinna, 2025).

5) Nigeria Renewable Energy Master Plan (REMP): The REMP seeks to boost Nigeria's energy mix's proportion of renewable energy, especially in neglected rural regions. In order to improve energy availability and support sustainable development, it encourages the development and deployment of solar, wind, and other renewable energy sources (Sambo, 2009).

8. Policy implications of Findings

The examination of Delta State's operational infrastructure sheds light on many implications for planning and policy intended to achieve balanced rural-urban growth. Encouraging sustainable development in both urban and rural regions requires the implementation of efficient policy and strategic planning frameworks.

1) Educational Facilities: Equal access to high-quality education in both urban and rural communities must be given top priority in policy. To close the gap, strategic frameworks should fund teacher preparation programs, school infrastructure, and educational materials in remote areas. Learning results can be improved by initiatives that incorporate technology into the classroom and programs that encourage teachers to work in rural regions.

2) Medical Facilities: The expansion of healthcare services and infrastructure in rural regions must be the primary goal of healthcare policy. This entails building new primary healthcare facilities, making improvements to current ones, and using incentives to guarantee a consistent supply of medical staff. In order to improve access to healthcare in rural places, strategic frameworks should also support telemedicine and mobile health clinics.

3) Energy/Power Facilities: The goal of energy policy should be to expand the availability and dependability of power in rural regions. Development frameworks might overcome the difficulties of expanding the grid infrastructure by including renewable energy sources like solar and wind power. Energy availability in underserved areas may be improved by promoting public-private partnerships and offering subsidies for renewable energy projects.

4) Transportation Facilities: Plans for infrastructure development must take into account the inadequate transportation systems in rural regions. Building and maintaining rural roads, creating effective public transportation systems, and combining rural and urban transportation networks should be the key priorities of policy. In addition to promoting sustainable practices, strategic development frameworks should take the environmental impact of transportation projects into account (Ozabor et al., 2024b).

5) Recreation and Tourism Facilities: By enhancing recreational and tourism amenities, plans for tourism development must fully realize the potential of rural communities. This entails creating infrastructure (like lodging facilities, green spaces, and cultural hubs) and boosting regional travel via marketing and capacity-building programs. To guarantee long-term advantages, strategic frameworks should prioritize community engagement and sustainable tourism practices.

6) Water Resource Facilities: Ensuring a sustainable and uncontaminated water supply in both urban and rural regions should be the main goal of water resource management policies. Investments in water infrastructure, such as irrigation systems, water treatment facilities, and boreholes, must be included in development frameworks. In addition, policies must to address problems with water pollution and misuse as well as community-based water management techniques.

7) Waste Management Facilities: In order to stop environmental deterioration and health risks, waste management strategies in rural regions need to strengthen infrastructure and services. In addition to encouraging trash segregation at the source and supporting community-based waste management activities, strategic frameworks should assist the development of recycling and waste treatment facilities. Additionally, policies must emphasize educating the public on the value of

disposing of garbage properly.

9. Conclusion

The analysis of the rural-urban populace's disparity in access to infrastructural facilities in Delta State gave some important revelations that can influence policy crafting as it relates to rural and urban development. When it comes to access to educational facilities, there is a big difference between urban and rural locations, with the urban centres having more schools, greater resources, and superior educational results. Also, due to the concentration of healthcare infrastructure in metropolitan areas, these places have higher health outcomes, while the rural areas struggle with issues of fewer healthcare facilities, a shortage of medical personnel, and subpar health services.

Furthermore, while rural communities frequently face power outages and lack access to renewable energy sources, urban areas benefit from a more comprehensive and dependable energy infrastructure. In the same vein, improved transportation networks improve connectivity and encourage economic growth in urban areas, while rural communities are cut off from markets and basic services due to inadequate road infrastructure and restricted transportation options.

As it relates to recreation and tourist facilities, though the rural areas have potential for tourism development, they lack the infrastructure needed to take advantage of this possibility, whereas the urban areas, with their well-developed recreational and tourist offerings, are boosting their local economies. Also, access to clean water and efficient water management systems are issues in rural locations, whereas urban areas often have better-managed water resources. As per waste management facilities, while urban areas have better-organized waste management systems, rural regions lack official facilities for recycling and disposing of garbage, which can cause problems for the environment and human health.

10. Recommendations

Equitable Resource Distribution: To solve infrastructure inequities, policies must guarantee that resources are distributed between urban and rural regions in an equitable manner. This involves giving rural regions first priority when allocating funds and initiating development initiatives.

Integrated Planning: Strategic frameworks ought to encourage integrated planning, which takes into account the interdependencies across various industries. For example, transportation infrastructure may enhance access to education and healthcare.

Community Involvement: In order to guarantee that development projects satisfy local needs and garner support from the community, it is imperative that local communities be involved in their design and execution.

Development strategies have to prioritize sustainability by endorsing eco-friendly techniques that provide enduring advantages for both urban and rural communities.

Monitoring and Evaluation: To determine the impact of development initiatives and make sure they accomplish their intended goals, it is imperative to establish strong monitoring and evaluation processes.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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