Assessment of the Per Capita Investment in Key Infrastructure Development in Rivers State, Nigeria.

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ABSTRACT

Public investment in core social infrastructure plays a critical role in economic development, human capital formation, and spatially inclusive growth. In developing contexts, however, infrastructure outcomes depend not only on aggregate expenditure levels but also on how equitably resources are distributed across populations and space. This study evaluates real per capita investment in education and healthcare infrastructure in Rivers State, Nigeria, within a spatial justice framework. Adopting a quantitative spatial-analytical approach, the study integrates inflation-adjusted capital expenditure data (constant 2010 ₦), population estimates, and Geographic Information System (GIS)-based analysis to examine inter-district investment patterns across the three senatorial districts from 2002 to 2024. Per capita investment levels were computed to enable population-adjusted comparison, while the coefficient of variation (CV) was applied annually to measure spatial inequality. The findings reveal pronounced temporal volatility and persistent inter-district disparities in both sectors. Educational infrastructure investment experienced episodes of extreme inequality during years of selective allocation, followed by periods of moderate but sustained imbalance despite increased funding. Healthcare investment exhibited even greater instability, characterized by cycles of sector-wide neglect, concentration in specific districts, and limited convergence. Although some years recorded relatively balanced distribution, high CV values in several periods indicate that fiscal expansion did not consistently yield equitable outcomes. Overall, infrastructure investment in Rivers State has been uneven and structurally imbalanced. Achieving spatial justice requires institutionalized population-adjusted allocation frameworks, strengthened medium-term planning, and routine GIS-based monitoring to ensure inclusive infrastructure provision.

Keywords: Spatial justice; Per capita investment; Infrastructure development; GIS; Budgetary allocation.

INTRODUCTION

Per capita investment in critical infrastructure, public utilities, and services assesses the average annual public spending committed to developing and maintaining the physical systems that enable economic activity, social welfare, and environmental sustainability (Beals, 2020a). These investments commonly span transportation, health, education, energy, water supply, sanitation, and telecommunications; sectors widely recognised as "foundational" for productivity and well-being. The scale, quality, and distribution of these investments are strongly shaped by public policy choices, fiscal institutions, and governance decisions, which influence both the growth effects of infrastructure and the equity of service access (Sutherland et al., 2009; OECD, 2021; OECD, 2022).

Investment spending, in public finance terms, refers to government expenditure on fixed assets (capital outlays) that generate public benefits beyond a single fiscal year, including new construction, rehabilitation, and major equipment purchases (Stupak, 2018). In many developing contexts, capital spending is formally expressed through annual budgetary allocations, yet the developmental impact depends not only on the size of allocations but also on the credibility of the budget, efficiency of project selection, and effectiveness of implementation (Edame & Foanta, 2014; OECD, 2025; World Bank, 2022). In this sense, infrastructure contributes to national and subnational development not merely through "how much" is budgeted, but through "how well" investment is planned, delivered, and maintained over the infrastructure lifecycle (Stupak, 2018; OECD, 2021).

Akanbi (2013) emphasised that infrastructure provision is a core responsibility of government, and that sustained capital budgeting can enhance an economy's infrastructure capacity. More recent public investment literature reinforces this argument while highlighting two additional issues: (1) the quality of institutions that govern budgeting and execution, and (2) the distributional (equity) consequences of where investments are located and who benefits (OECD, 2022; OECD, 2025). This aligns with Nurlis (2016), who noted that infrastructure development success in many settings reflects attention to demographic realities; population size, growth, settlement patterns, and service needs, during capital spending planning. Current evidence similarly stresses the importance of needs-based allocation rules and robust subnational public investment systems to avoid persistent regional inequalities (OECD, 2022).

Nigeria generally, and Rivers State in particular, has faced concerns about spatial injustice in the distribution of public infrastructure, often linked to inadequate and uneven per capita investment across regions and sectors (Aregbeyen & Akpan, 2013). Beals (2020b) further argues that, despite large nominal allocations in some years, implementation has not consistently translated into equitable infrastructure outcomes. Related empirical work on public spending in developing countries continues to show that weak budget credibility, inefficiencies, and governance constraints can sever the link between allocations and outcomes, making "high budget figures" a poor proxy for real service improvement (Edame & Foanta, 2014; World Bank, 2022; OECD, 2025). In the social sectors specifically, recent Nigeria-focused evidence underscores that low and inefficient public health financing and uneven investment patterns can entrench access gaps and poor outcomes, particularly for vulnerable populations (The Lancet Nigeria Commission, 2022).

Against this background, this study highlights the structural and dysfunctional dynamics that can arise between budgetary allocation, implementation, and spatially equitable outcomes in education and healthcare infrastructure across Rivers State. By examining capital spending and per capita investment trends from 2002 to 2024, and situating findings within a spatial justice lens, the study contributes to the growing policy concern that infrastructure inequities are not only "development" problems but also "justice" problems, reflecting how public resources and opportunities are distributed across territory.

Budgetary Allocations and Per Capita Investment

The findings of Ibrahim and Ahmad (2013) on equitable budgetary allocation as a driver of national development provide a relevant foundation for interrogating how investment decisions shape human development outcomes. In Rivers State, disparities in sectoral and regional allocations may weaken the capacity of public investment to reduce poverty and improve welfare, particularly where service needs are greatest. Contemporary budgeting research extends this argument by emphasising equity-oriented budgeting tools and performance-informed allocation systems that explicitly evaluate who benefits and who bears the burden of public spending decisions (OECD, 2025; equity-focused budgeting scholarship, 2023–2024).

Accordingly, a shift toward evidence-based and results-oriented budgeting is increasingly presented as a practical route to improve both efficiency and fairness. Such approaches prioritise transparent project appraisal, distributional impact checks, and implementation monitoring; measures that help reduce the gap between approved capital budgets and delivered infrastructure outcomes (OECD, 2025; OECD, 2022). In Rivers State, adopting an equity-sensitive capital allocation and execution framework can therefore strengthen the link between infrastructure spending and inclusive development, consistent with the reform logic implied by Ibrahim and Ahmad (2013).

Analysis of Data on Budgetary Allocations and Per Capita Investment

While Ibrahim and Ahmad (2013) provide useful insight into budget allocation challenges, a key gap remains: limited empirical work that systematically analyses allocation and per capita investment patterns across sectors and senatorial districts over time, and then interprets these patterns through a spatial justice lens. Addressing this gap requires combining (i) longitudinal fiscal analysis, (ii) population-adjusted investment metrics (per capita investment), and (iii) spatial analytical tools capable of revealing geographic disparities. This study responds to that need by integrating budget and demographic data with GIS-based visualization and comparison across districts (Longley et al., 2015; Wong, 2004), while also using qualitative insights to interpret implementation bottlenecks and governance dynamics.

2. Theoretical Framework: Spatial Justice and Public Infrastructure Investment

Spatial justice provides a robust theoretical framework for interrogating the equity implications of public investment decisions across geographic space. Emerging from broader debates on social justice, spatial justice extends concerns of fairness and distributive equity to the spatial organization of resources, opportunities, and public services (Soja, 2010). Contemporary scholarship further emphasizes that justice is not merely a social or economic condition but also a spatial outcome shaped by institutional arrangements, planning decisions, governance systems, and patterns of public investment (Davoudi & Brooks, 2014; Fitjar & Rodríguez-Pose, 2024).

Drawing on Rawlsian principles of distributive justice, spatial justice foregrounds the normative expectation that public resources should be allocated in ways that improve the conditions of the least advantaged and correct structural inequalities (Rawls, 1971). In infrastructure provision, this principle implies that investment decisions should be responsive to population size, service deficits, and historical marginalization rather than driven solely by political influence, economic concentration, or administrative convenience. Recent justice-oriented planning literature reinforces this view, arguing that equity-sensitive public investment is essential for inclusive and sustainable development, particularly in regions characterized by entrenched spatial inequalities (Moreno-Monroy, Schiavina, & Veneri, 2020; UN-Habitat, 2023).

Critical urban and regional theorists further contend that spatial injustice often emerges from systemic biases embedded within state institutions, fiscal systems, and planning practices, which tend to privilege core or urban regions over peripheral and rural areas (Harvey, 1973; Soja, 2010). These centre–periphery dynamics remain highly relevant in contemporary development contexts, where uneven development is reinforced through centralized budgeting systems, weak subnational autonomy, and limited accountability in public investment decision-making (Shah, 2007; OECD, 2022). Recent regional development studies demonstrate that such institutional biases continue to shape spatial disparities in infrastructure access across both developed and developing regions (Rodríguez-Pose, 2018; Fitjar & Rodríguez-Pose, 2024).

Within this framework, per capita investment serves as a key operational metric for evaluating spatial justice in public infrastructure provision. By relating public expenditure directly to population size, per capita measures enable meaningful comparisons across regions with differing demographic scales and reveal whether investment levels align with principles of equity and proportionality (UN-Habitat, 2020; OECD, 2022). Unlike aggregate expenditure figures, which can obscure distributive imbalances, persistent disparities in per capita investment signal structural spatial injustice, even in contexts where overall public spending appears substantial (World Bank, 2022).

Applying a spatial justice lens to infrastructure development underscores the political nature of budgetary allocation processes. Public budgets are not neutral technical instruments but inherently political tools that shape spatial outcomes by determining who receives infrastructure, where investments are concentrated, and at what scale (Allen, Hemming, & Potter, 2013). When budgeting and capital investment frameworks fail to incorporate demographic realities, spatial need, and equity considerations, they risk reproducing patterns of uneven development and social exclusion (OECD, 2025; UN-Habitat, 2023).

In this study, spatial justice provides the conceptual foundation for examining how budgetary allocations and per capita investment in healthcare and education infrastructure are distributed across Rivers State's senatorial districts. By analyzing investment patterns relative to population size and spatial location, the study evaluates the extent to which public infrastructure provision reflects principles of equity, fairness, and inclusive development, while also revealing how fiscal and planning practices may perpetuate or mitigate spatial injustice.

3. METHODOLOGY

3.1 Study Area

The study was conducted across the three senatorial districts of Rivers State; Rivers East, Rivers West, and Rivers South East. Collectively, these districts capture the geographic, socio-economic, and infrastructural diversity of the state, encompassing highly urbanized metropolitan areas, peri-urban settlements, rural

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hinterlands, and riverine/coastal communities. This spatial heterogeneity provides a suitable basis for examining variations in per capita infrastructure investment and associated patterns of spatial (in)justice.

Rivers State is located in the Niger Delta region of southern Nigeria, approximately between latitudes 4°50′11″N and 5°50′25″N and longitudes 6°50′35″E and 7°55′28″E (Ibrahim & Ahmad, 2013) (Figure 1).

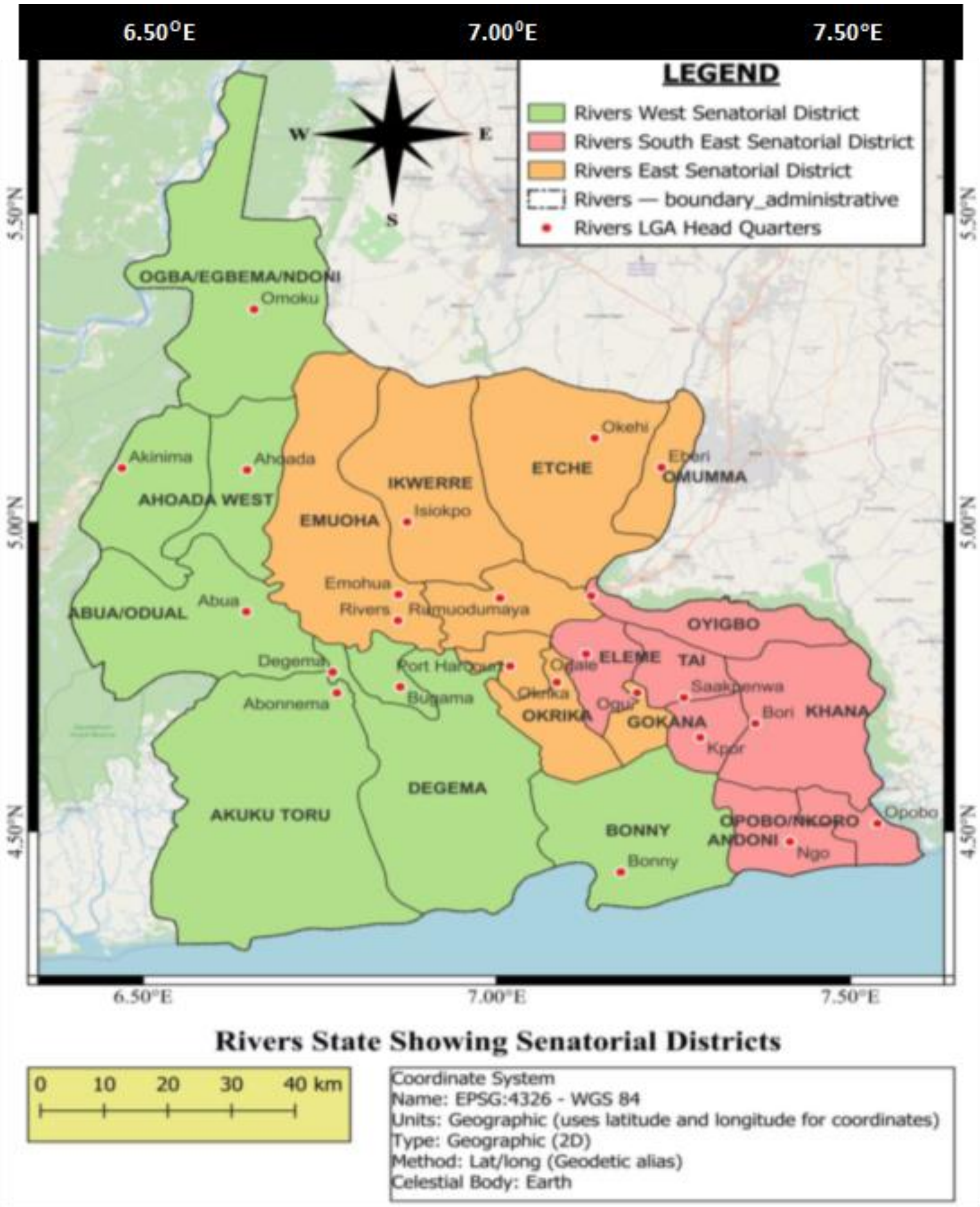

Figure 1. Senatorial Districts in Rivers State

Source: OSM, (2023); Researcher, (2024)

The state's geographic extent and ecological diversity have important implications for infrastructure planning and service delivery, particularly in relation to population distribution, accessibility, and construction costs.

The state experiences a humid tropical climate characterized by high temperatures and substantial annual rainfall. Climatic and vegetation conditions vary across the senatorial districts, with dense mangrove and freshwater swamp forests dominating the coastal and riverine zones and rainforest vegetation prevalent inland. These environmental conditions influence infrastructure development by affecting settlement patterns, construction feasibility, maintenance requirements, and accessibility (Ayoola et al., 2011; IPCC, 2022).

Livelihood systems within the senatorial districts further reflect these spatial contrasts. Communities in Rivers West, particularly in coastal and estuarine areas, are largely dependent on fishing, marine-based activities, and related informal economies, while Rivers East and parts of Rivers South East exhibit stronger reliance on agriculture, trading, and service-oriented activities (Siloko, 2024). These livelihood variations shape population concentration, service demand, and infrastructure needs, reinforcing the relevance of a population-adjusted (per capita) approach to infrastructure investment analysis.

3.2 Research Design

The study adopted a mixed-methods research design, integrating quantitative spatial and fiscal analysis with qualitative inquiry to capture both the distributional patterns and governance dynamics of infrastructure investment. This approach is well suited to spatial justice research, where understanding inequities requires both empirical measurement and contextual interpretation.

The quantitative component focused on the analysis of capital expenditure data for healthcare and education infrastructure and corresponding population estimates across selected Local Government Areas within the three senatorial districts from 2002 to 2024. Per capita investment levels were computed by relating sector-specific capital expenditure to population figures, enabling population-adjusted comparison of investment intensity across space and time. Geographic Information System (GIS) techniques were then applied to visualize and analyze spatial patterns of infrastructure investment, population distribution, and inter-district disparities.

GIS provides a robust platform for integrating spatial and non-spatial datasets and for identifying geographic patterns that may not be apparent through tabular analysis alone (Longley et al., 2015). In this study, spatial mapping was used to examine the distribution of infrastructure investment relative to population size, enabling the identification of spatial concentration, underinvestment, and temporal volatility across senatorial districts. Consistent with spatial analysis literature, the approach acknowledges the influence of scale and aggregation effects on spatial interpretation (Wong, 2004; Fotheringham et al., 2000), and therefore emphasizes comparative analysis across consistent administrative units.

The qualitative component involved structured interactions with selected key stakeholders using interview guides and checklists. These interactions provided contextual insights into budgetary processes, implementation challenges, institutional constraints, and political dynamics influencing infrastructure allocation and execution. Qualitative findings were analyzed using content analysis to identify recurring themes related to budgeting practices, accountability, and spatial equity. This qualitative layer was used to complement and interpret quantitative patterns, particularly where discrepancies emerged between budgetary allocations and observed per capita investment outcomes.

By combining quantitative GIS-based analysis with qualitative stakeholder perspectives, the study adopts a triangulated methodological approach that strengthens analytical robustness and enhances interpretive depth. This integration supports a more comprehensive assessment of spatial justice in per capita infrastructure investment, linking measurable investment patterns to the institutional and governance contexts within which they occur.

3.3 Data Sources

This study relied on a combination of secondary quantitative datasets and primary qualitative information to examine per capita investment in healthcare and education infrastructure across the senatorial districts of Rivers State.

Budgetary and Fiscal Data

Sectoral capital expenditure data for healthcare and education infrastructure covering the period 2002–2024 were obtained from official records of the Rivers State Ministry of Budget and Economic Planning. These data include annual capital allocations approved in state budgets and disaggregated by sector and senatorial district.

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Budgetary data were selected because public capital budgets represent the principal formal mechanism through which government infrastructure investment decisions are articulated and implemented.

Population Data

Population figures for selected Local Government Areas within each senatorial district were derived from the 1991 National Population Census (NPC) baseline and projected annually to 2024 using officially adopted growth assumptions applied by the Rivers State Government. While acknowledging the limitations associated with census-based projections in the Nigerian context, these estimates remain the most consistent and officially recognized demographic data available for longitudinal per capita analysis at the sub-state level.

Spatial Data

Spatial boundary data for Rivers State senatorial districts and Local Government Areas were sourced from OpenStreetMap (OSM) and verified against official administrative maps. These datasets were used to support GIS-based visualization and spatial comparison of investment patterns across districts.

Qualitative Data

Primary qualitative data were generated through structured interactions with purposively selected key informants, including planning officials, budget officers, and sectoral stakeholders with direct experience in infrastructure planning, budgeting, or implementation. Data were collected using interview guides and checklists designed to elicit information on budget preparation, allocation criteria, implementation challenges, and accountability mechanisms.

3.4 Analytical Procedures

The analytical process followed a sequential mixed-methods strategy, integrating fiscal analysis, population-adjusted computation, spatial visualization, and qualitative interpretation.

Step 1: Compilation and Harmonization of Budget Data

Annual capital expenditure figures for healthcare and education were compiled for each senatorial district and standardized to ensure consistency in currency units and temporal coverage. Where discrepancies or missing values occurred, cross-validation was conducted using supplementary budget documents and official summaries.

Step 2: Population Adjustment and Per Capita Computation

To enable equitable comparison across districts with different population sizes, capital expenditure figures were normalized using population data. This produced per capita investment values, allowing assessment of how much infrastructure investment was effectively allocated per resident in each senatorial district over time.

Per Capita Investment Computation

$$\text{Per Capita Investment}_{i,t} = \frac{\text{Capital Expenditure}_{i,t}}{\text{Population}_{i,t}}$$

Where:

- i = Senatorial district
- t = Year
- Capital Expenditure = Annual sector-specific capital spending (₦)
- Population = Estimated population of the district for year t

This approach follows established public finance and spatial equity practice, enabling population-sensitive evaluation of infrastructure investment and avoiding distortions inherent in aggregate expenditure comparisons.

Step 3: GIS-Based Spatial Analysis

Computed per capita investment values were integrated with spatial boundary datasets and analyzed using Geographic Information System (GIS) software. Spatial visualization techniques were applied to map:

- Inter-district variation in per capita investment
- Temporal trends in investment distribution
- Areas of persistent underinvestment or volatility

GIS-based mapping enhanced interpretability by revealing spatial patterns and contrasts that are not readily apparent in tabular data alone. In line with spatial analysis literature, the study remained attentive to scale and aggregation effects inherent in administrative boundary-based analysis (Wong, 2004; Fotheringham et al., 2000).

Step 4: Temporal Trend Analysis

Time-series plots and descriptive trend analysis were used to examine changes in per capita investment between 2002 and 2024. Particular attention was paid to periods of investment volatility, zero allocation, and sharp increases or declines, as these fluctuations have significant implications for infrastructure continuity and service delivery.

Step 5: Qualitative Content Analysis

Qualitative data from key informant interactions were analyzed using content analysis techniques. Responses were coded thematically to identify recurring issues related to:

- Budget formulation and prioritization
- Political and institutional influences on allocation
- Implementation bottlenecks
- Accountability and transparency challenges

These insights were used to contextualize quantitative findings and to explain observed spatial disparities in per capita investment.

3.4.1 Construction of the Consumer Price Index (CPI) Series (2010 = 100)

To enable meaningful inter-temporal comparison of executed capital expenditure between 2002 and 2024, all nominal values were converted into constant prices using a Consumer Price Index (CPI) series constructed for this study. Given the absence of a consistent, readily available CPI index series covering the entire study period in index form, the CPI was derived cumulatively from Nigeria's annual headline inflation rates.

The year 2010 was selected as the base year ($CPI_{(2010)} = 100$) because it lies approximately at the midpoint of the study period and provides a neutral benchmark for long-term fiscal analysis. The CPI series was constructed using standard inflation compounding procedures. For years after 2010, the index was computed as:

$$CPI_t = CPI_{t-1} \times (1 + \pi_t)$$

where π_t represents the annual inflation rate expressed as a decimal. For years prior to 2010, the index was derived through backward chaining:

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$CPI_{t-1} = CPI_t / (1 + \pi_t)$

This chained-index approach ensures internal consistency across the full time series while preserving the inflation trajectory observed in official macroeconomic data.

The constructed CPI series reveals substantial price-level changes over the study period, particularly during the post-2015 recessionary period and the sharp inflation acceleration observed after 2020. By 2024, the CPI index indicates that the general price level is several times higher than in 2010, reinforcing the necessity of inflation adjustment for longitudinal fiscal analysis.

All capital expenditure figures were therefore deflated using the formula:

$\text{Real Expenditure}_t = (\text{Nominal Expenditure}_t \times 100) / CPI_t$

As a result, all reported real values are expressed in constant 2010 Naira. This adjustment ensures that observed changes in infrastructure investment reflect real variations in fiscal effort rather than inflation-driven nominal increases.

3.5 Methodological Rigor and Theoretical Alignment

The integration of fiscal analysis, per capita normalization, spatial visualization, and qualitative interpretation ensures a triangulated and methodologically robust assessment of infrastructure investment patterns. By explicitly linking public expenditure to population distribution and spatial location, the methodology operationalizes the study's spatial justice framework and allows for systematic evaluation of equity in infrastructure provision.

This approach strengthens both internal validity (through consistent population-adjusted comparison) and external relevance (by aligning with international public investment and spatial justice research practices).

3.6 Analytical Measure: Coefficient of Variation (CV)

To rigorously evaluate spatial inequality in real per capita infrastructure investment across Rivers State's three senatorial districts (Rivers West, Rivers East, and Rivers South East), this study adopts the coefficient of variation (CV) as a standardized measure of inter-district dispersion.

The CV, computed as the ratio of the standard deviation to the mean of per capita investment values in a given year, provides a scale-independent indicator of spatial disparity. This standardization is particularly important in the present study because real investment levels fluctuate substantially across time due to inflation adjustment (2010 constant ₦), fiscal expansions, episodic capital injections, and years of zero allocation.

The annual CV values derived from Tables 2,4 and 5 reveal several important patterns:

- Low-to-moderate disparity years (CV ≈ 0.23–0.30) indicate relatively proportional distribution across districts (e.g., 2002, 2007, 2014, 2016, 2019–2022, 2024 in education; similar clustering in healthcare).
- High disparity years (CV > 0.65) correspond to years where one or two districts recorded zero or near-zero allocation while others received substantial funding (e.g., 2008–2010 and 2013 in education; 2009, 2012, and 2015 in healthcare).
- Extreme CV values (≈1.41) in 2010 and 2013 (education) occurred when investment was concentrated in a single district, while others recorded zero allocation.
- Years in which all districts recorded zero allocation (e.g., 2011 in education; 2002, 2007, and 2017 in healthcare) produce undefined or non-informative CV values, signifying sector-wide neglect rather than equitable allocation.

Thus, the CV provides a transparent quantitative basis for identifying periods of spatial injustice, distinguishing between:

1. Equitable scarcity (all districts equally underfunded), and
2. Selective allocation (one district prioritized while others receive minimal or no investment).

By complementing GIS-based spatial visualization, the CV strengthens the spatial justice framework by moving beyond aggregate spending to evaluate the proportional fairness of distribution.

RESULTS

4.1 Population Dynamics Across Senatorial Districts (2002–2024)

Population estimates across the three senatorial districts demonstrate sustained demographic growth over the study period. Rivers East consistently maintained the highest population totals, followed by Rivers West, while Rivers South East recorded comparatively lower population figures.

These demographic differences are analytically significant because:

i. They directly determine the computation of real per capita investment (PCI).

ii. They influence the interpretation of spatial equity, since identical aggregate allocations produce different per capita outcomes depending on population size.

iii. They help explain why districts with similar aggregate allocations sometimes exhibit divergent PCI values.

The persistent population dominance of Rivers East implies that high PCI values in that district reflect not only fiscal prioritization but also the scale of demographic concentration.

4.2 Capital Investment in Educational Infrastructure (Real 2010 ₦)

Real executed capital expenditure in education (Table 1) shows substantial volatility between 2002 and 2024.

Key Observations:

- **Early Instability (2002–2007)**
  Investment fluctuated considerably. Although allocations were recorded in all districts, magnitudes varied sharply.
- 2006 stands out for Rivers West, which recorded ₦2.68 billion (real 2010 ₦), far exceeding allocations in other districts that year.
- **Partial or Zero Allocation Years (2008–2013)**
  Several years recorded zero allocations in one or more districts:
- 2008: Rivers East recorded zero.
- 2009–2010: Allocation concentrated in Rivers West and Rivers East, with Rivers South East receiving zero in 2009 and both RE and RSE receiving zero in 2010.
- 2011: All districts recorded zero.
- 2013: Only Rivers South East recorded investment.

These patterns reflect sectoral discontinuity and spatial selectivity.

- **Peak Rebound Period (2014–2018)**
  A strong resurgence occurred in 2014:

- Rivers West: ₦1.84 billion
- Rivers East: ₦1.79 billion
- Rivers South East: ₦1.79 billion

Another peak occurred in 2018, especially for Rivers South East (₦2.28 billion), marking one of the highest real allocations across the entire series.

- **Post-2018 Moderation (2019–2024)**
  Although allocations remained positive, real values moderated relative to 2014–2018 peaks. Inter-district allocations became more balanced, especially between 2019 and 2022.

Overall, Rivers East and Rivers West recorded consistently higher real allocations relative to Rivers South East across most years.

Table 1: Real Executed Capital Expenditure in Education (Constant 2010 ₦, 2002–2024)

Year	CPI	Rivers West Real 2010	Rivers East Real 2010	Rivers South East Real 2010	Total Nominal Real 2010
2002	39.74	24068908.42	24068908.42	24068908.42	72206725.26
2003	45.30	287905603.4	287905603.4	287905603.4	863716810.3
2004	52.10	83450899.53	92407962.75	141032020.2	316890882.5
2005	61.43	183039886.5	202304138.5	183039805.1	568383830.2
2006	66.46	2682082611	248148105.5	313346948.8	3243577665
2007	70.05	239572326.6	239572326.6	239572255.2	718716908.4
2008	78.18	12791250	0	51165000	63956250
2009	87.95	341100000	1137000000	0	1478100000
2010	100.00	1000000000	0	0	1000000000
2011	110.80	0	0	0	0
2012	124.32	104570873.3	160878266.6	80439133.32	345888273.3
2013	134.88	0	0	74137450.06	74137450.06
2014	145.81	1843968914	1789103086	1789103086	5422175087
2015	158.93	547126326.1	547126326.1	54712636.17	1148965288
2016	183.89	391522463.3	391522463.3	391522463.3	1174567390
2017	214.23	37322002.7	336070784	336071717.6	709464504.2

2018	240.15	1443217148	1443217148	2276035800	5162470097
2019	267.53	325040535.3	325040535.3	325040535.3	975121605.8
2020	302.84	388412989.1	388412989.1	388412989.1	1165238967
2021	354.32	515621821.1	515621821.1	515621821.1	1546865463
2022	420.93	577691335.5	577691335.5	577691335.5	1733074007
2023	524.06	332461456.6	141644355	332461495.8	806567307.4
2024	697.00	397315530.9	397315530.9	397315530.9	1191946593

Source: Author's computation using Rivers State Ministry of Budget and Economic Planning (2024), deflated using constructed CPI (2010=100)

Table 1 reveals substantial real-term volatility in executed educational capital expenditure across the study period. Although nominal figures suggested sustained growth after 2014, inflation-adjusted values indicate that real investment peaks were concentrated in select years, with notable contraction in post-2018 real terms. Rivers East consistently recorded higher real allocations relative to Rivers South East, reflecting spatial concentration of fiscal effort.

4.3 Per Capita Investment in Educational Infrastructure

When normalized by population (Table 2), deeper spatial inequities emerge.

Phase I: Low-to-Moderate Investment (2002–2007)

- PCI levels were modest but uneven.
- 2006 shows extreme imbalance:
    - i. Rivers West: ₦8,635.36
    - ii. Rivers East: ₦881.42
    - iii. Rivers South East: ₦558.34
    - iv. CV = 1.11 (very high disparity)

Phase II: Selective Allocation (2008–2010)

i. 2008: Rivers East recorded zero PCI (CV = 0.84).

ii. 2009: Rivers East peaked at ₦3,647.01, while Rivers South East recorded zero (CV = 0.89).

iii. 2010: Rivers West alone recorded PCI (₦2,810.24); RE and RSE were zero (CV = 1.41).

These years represent maximum spatial concentration.

Phase III: Sectoral Stagnation (2011–2013)

i. 2011: All districts zero.

ii. 2013: Only Rivers South East recorded PCI (₦104.12), yielding CV ≈ 1.41.

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Phase IV: Peak Rebound (2014–2018)

- 2014:
  i. RW: ₦4,523.07
  ii. RE: ₦4,841.52
  iii. RSE: ₦2,428.72
  iv. CV = 0.27 (moderate inequality)
- 2018:
  i. RW: ₦3,089.92
  ii. RE: ₦3,408.90
  iii. RSE: ₦2,696.85
  iv. CV = 0.095 (lowest disparity in entire series)

2018 represents the most spatially balanced year in educational PCI.

Phase V: Stabilization with Moderate Inequality (2019–2024)

i. PCI values stabilized between ₦600–₦1,200 across districts.

ii. CV values clustered around 0.23–0.27, indicating reduced but persistent disparity.

iii. 2023 showed renewed divergence (CV = 0.345), driven by lower allocation in Rivers East relative to others.

Overall, Rivers East maintained the highest PCI in most years, while Rivers South East lagged consistently except in selected rebound years.

Table 2: Real Per Capita Investment in Educational Facilities Per Senatorial District (2002 to 2024)

Year	RW PCI	RE PCI	RSE PCI	CV
2002	88.78272668	97.94779849	49.13496175	0.269434375
2003	1026.489266	1132.456716	568.0908522	0.269434001
2004	287.5871868	351.3303504	268.9797877	0.116519474
2005	609.7041299	743.4372281	337.4279299	0.299790116
2006	8635.36078	881.4237348	558.3357366	1.111765611
2007	745.5508458	822.5150946	412.6102779	0.269434124
2008	38.4759421	0	85.17477768	0.844954971
2009	1398.260271	3647.012785	0	0.89330422
2010	2810.243901	0	0	1.414213562

2011	0	0	0	0
2012	274.5507071	465.9882999	116.8803102	0.499445701
2013	0	0	104.1227073	1.414213562
2014	4523.068071	4841.524536	2428.718156	0.272257539
2015	1297.181063	1431.091527	71.78986589	0.655341708
2016	897.2320623	989.8529169	496.5540786	0.269434479
2017	82.66975007	821.2572461	411.9793191	0.688762482
2018	3089.91774	3408.895213	2696.849499	0.095006379
2019	672.6470332	742.0847361	372.262392	0.269434585
2020	776.9207626	857.124864	429.9709737	0.269434879
2021	996.892713	1099.803172	551.7102949	0.269434171
2022	1079.560798	1191.00565	597.4607131	0.26943461
2023	600.5195894	282.2612789	332.3448427	0.344970914
2024	693.6737799	562.0621214	383.8990277	0.232259212

Source: Author's computation using Rivers State Ministry of Budget and Economic Planning (2024), deflated using constructed CPI (2010=100)

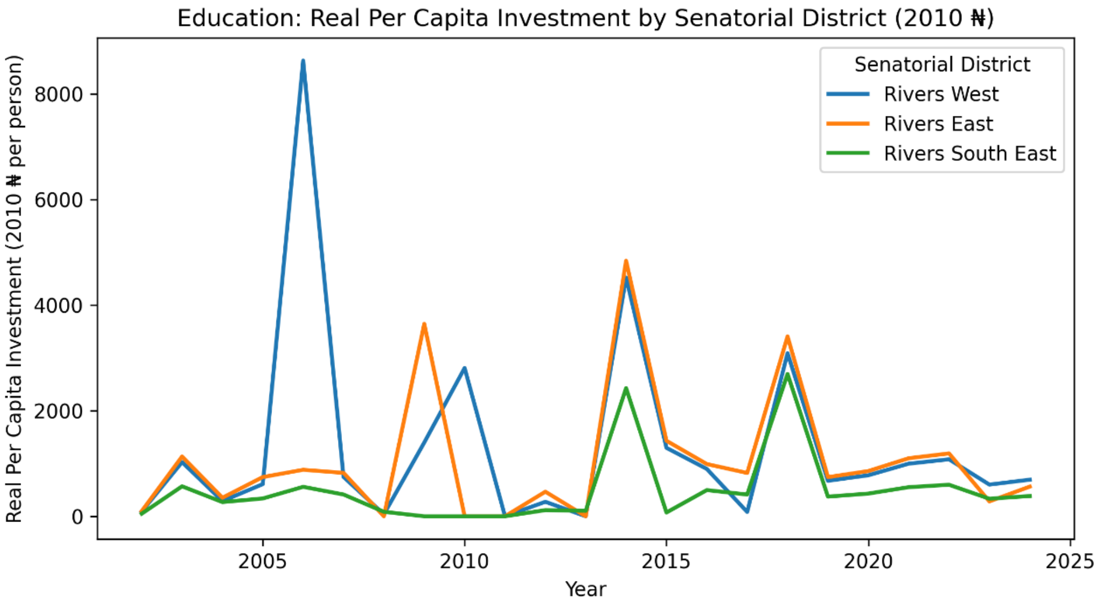

Figure 2: Real Per Capita Investment in Educational Facilities Per Senatorial District (2002 - 2024)

4.4 Capital Investment in Healthcare Infrastructure (Real 2010 ₦)

Real executed capital expenditure in healthcare infrastructure (Table 3) demonstrates even greater volatility than observed in the education sector. Rather than reflecting a steady and progressively expanding investment trajectory, healthcare funding between 2002 and 2024 was characterized by sharp fluctuations, intermittent surges, and multiple years of complete allocation gaps.

Notably, three years—2002, 2007, and 2017—recorded zero capital expenditure across all senatorial districts. These periods represent sector-wide suspension of capital investment rather than spatial imbalance, suggesting discontinuity in healthcare infrastructure programming.

Conversely, several peak years stand out for their substantial allocations. In 2008, all three districts recorded approximately ₦1.61 billion (real 2010 ₦), marking one of the most expansive and spatially synchronized investment years in the series. In 2009, Rivers West experienced a particularly pronounced surge, reaching approximately ₦1.88 billion—substantially higher than Rivers East and Rivers South East in that year. Another coordinated expansion occurred in 2018, when each district recorded approximately ₦1.44 billion. By 2024, investment had moderated to about ₦404 million per district, reflecting a rebound from earlier contractions but at a significantly lower magnitude than the 2008 and 2018 peaks.

Beyond aggregate volatility, the data reveal instances of selective allocation. In 2010 and 2012, Rivers East recorded zero capital expenditure while other districts received funding. In 2015, Rivers East's allocation was markedly lower than those of Rivers West and Rivers South East. Similarly, in 2016, a large disparity emerged between Rivers West and Rivers East, further underscoring uneven fiscal prioritization.

Overall, the pattern suggests episodic and discontinuous healthcare capital programming, with funding cycles driven by periodic injections rather than sustained and evenly distributed sectoral planning.

4.5 Per Capita Investment in Healthcare Infrastructure

When healthcare expenditure is normalized by population (Table 5), spatial inequality becomes more pronounced. The per capita investment (PCI) figures reveal that disparities were not merely a function of aggregate allocations but were amplified by demographic differentials across districts.

Several years exhibited extreme inter-district inequality. In 2009, Rivers West recorded a per capita investment of ₦7,722.85, compared to ₦2,395.93 in Rivers East and ₦1,201.90 in Rivers South East. The resulting coefficient of variation (CV = 0.75) indicates substantial dispersion and strong spatial concentration of healthcare investment.

In 2012, Rivers East recorded zero per capita investment, while Rivers West and Rivers South East recorded ₦422.39 and ₦116.88 respectively. The CV of 0.99 reflects near-maximum inequality, driven by the exclusion of one district from capital allocation. Similarly, in 2015, Rivers West recorded ₦346.99, Rivers East ₦93.02, and Rivers South East ₦46.66, producing a high CV of 0.81. These years illustrate selective fiscal distribution and heightened spatial injustice.

In contrast, relatively balanced allocation occurred in 2008, 2014, and throughout the 2018–2022 period, when CV values clustered between approximately 0.26 and 0.27. Although not perfectly equal, these years demonstrate moderate and more stable proportionality across the three senatorial districts.

Following the 2018 peak, a pattern of partial convergence is observable. Between 2019 and 2024, per capita investment levels across districts became more closely aligned. In 2024, for example, Rivers West recorded ₦705.44, Rivers East ₦571.60, and Rivers South East ₦390.41, yielding a CV of 0.232. While disparities remain evident—particularly for Rivers South East—the magnitude of inequality is significantly lower than during peak divergence years such as 2009 and 2012.

Taken together, the per capita analysis confirms that healthcare infrastructure investment in Rivers State has been characterized by alternating phases of sharp spatial concentration and moderate proportionality. Although recent years suggest some stabilization, the historical pattern reflects structural volatility and intermittent spatial imbalance in public healthcare capital allocation.

Table 3: Real Executed Capital Expenditure in Healthcare (Constant 2010 ₦, 2002–2024)

Year	CPI	Rivers West Real 2010	Rivers East Real 2010	Rivers South East Real 2010	Total Nominal Real 2010
2002	39.74	0	0	0	0
2003	45.30	58010235.22	58019064.32	58019064.32	174048363.9
2004	52.10	83450899.55	83450899.55	83450899.55	250352698.6
2005	61.43	233577581.4	70781085.27	282416530.3	586775196.9
2006	66.46	39250139.71	39250139.71	39250139.71	117750419.1
2007	70.05	0	0	0	0
2008	78.18	1611614079	1611614079	1611614079	4834842236
2009	87.95	1883959565	746959565.2	746959565.2	3377878696
2010	100.00	100000000	0	100000000	200000000
2011	110.80	189882641	190063146.4	190072171.7	570017959.2
2012	124.32	160878266.6	0	80439133.32	241317399.9
2013	134.88	638001108.3	644673518.1	644673478.8	1927348105
2014	145.81	236100002.6	236100002.6	236100002.6	708300007.9
2015	158.93	146356292.2	35563211.2	35563211.2	217482714.6
2016	183.89	510714288.8	75661376.12	619477517	1205853182
2017	214.23	0	0	0	0
2018	240.15	1443217190	1443217148	1443217144	4329651483
2019	267.53	325040535.2	325040535.3	325040535.3	975121605.8
2020	302.84	278524133.6	278524133.6	278524133.6	835572400.7
2021	354.32	208604734.8	208604734.8	208604734.8	625814204.4
2022	420.93	537189972	537189972.1	537189995.7	1611569940
2023	524.06	144623815.6	144623815.6	144623815.6	433871446.8
2024	697.00	404057641.3	404057641.3	404057641.3	1212172924

Source: Author's computation using Rivers State Ministry of Budget and Economic Planning (2024), deflated using constructed CPI (2010=100)

Table 4: Real Per Capita Investment in Healthcarel Facilities Per Senatorial District (2002 to 2024)

Year	RW PCI	RE PCI	RSE PCI	CV
2002	0	0	0	
2003	206.8278042	228.2139642	114.482314	0.26942197
2004	287.5871869	317.276054	159.1596377	0.269434327
2005	778.0447133	260.1098239	520.6256918	0.406947604
2006	126.3716172	139.4167595	69.93767054	0.269434326
2007	0	0	0	
2008	4847.717775	5348.14074	2682.866625	0.269434254
2009	7722.854916	2395.928834	1201.900562	0.751226004
2010	281.0243901	0	155.5268004	0.789913214
2011	515.7780051	569.5629201	285.7312947	0.269343543
2012	422.3857032	0	116.8803102	0.990665767
2013	1619.078468	1804.893088	905.4148462	0.26866255
2014	579.1292766	638.9145289	320.5071678	0.269434951
2015	346.9959345	93.02094926	46.66340979	0.813769083
2016	1170.37789	191.2882168	785.6614026	0.562682865
2017	0	0	0	
2018	3089.917828	3408.895212	1710.051939	0.269434514
2019	672.6470331	742.0847361	372.262392	0.269434585
2020	557.1162353	614.629188	308.3246345	0.269434879
2021	403.3121399	444.9465475	223.2050217	0.269434171
2022	1003.873867	1107.505432	555.5733627	0.269434595
2023	261.2315883	288.1985884	144.5730705	0.269434692
2024	705.4448406	571.5998429	390.4134713	0.232259212

Source: Author’s computation using Rivers State Ministry of Budget and Economic Planning (2024), deflated using constructed CPI (2010=100)

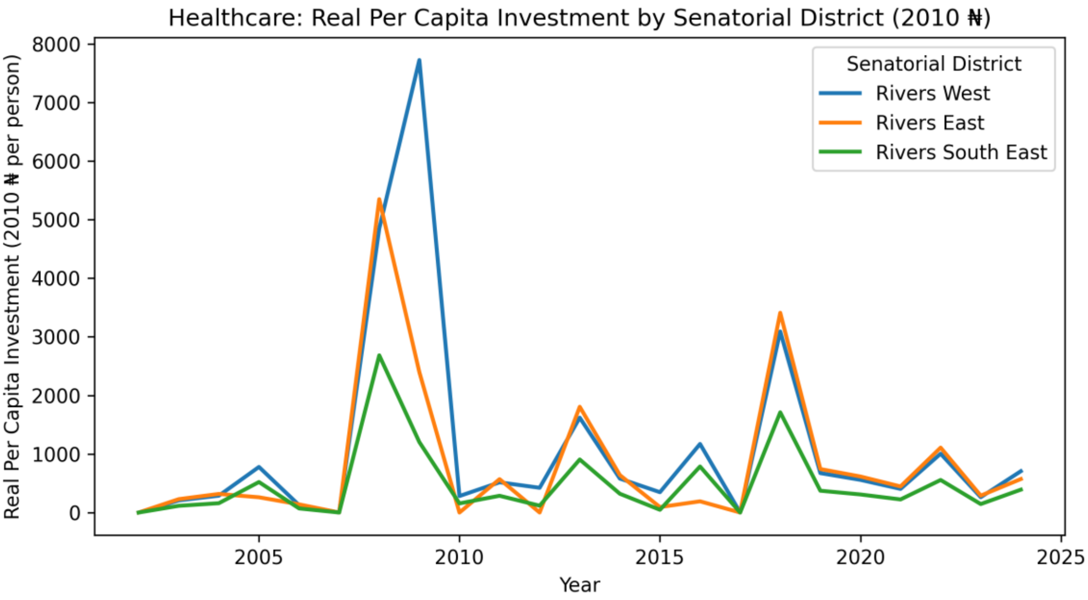

Figure 3: Real Per Capita Investment in Healthcare Facilities Per Senatorial District (2002-2024)

Source: Research's Computation 2024

4.6 Coefficient of Variation (CV) Analysis

4.6.1 Educational Investment

A. Method Used

For each year, the coefficient of variation (CV) was computed using the formula:

$$CV_t = \frac{(\text{Standard Deviation of (RW, RE, RSE)})}{(\text{Mean of (RW, RE, RSE)})}$$

Where:

RW = Rivers West

RE = Rivers East

RSE = Rivers South East

B. Results: Coefficient of Variation by Year

Spatial Inequality Metrics: Education vs Healthcare

Table 5: Comparative Coefficient of Variation Results (2002–2024)

Year	Education CV	Healthcare CV
2002	0.27	0.00
2003	0.27	0.27
2004	0.12	0.27

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2005	0.30	0.41
2006	1.11	0.27
2007	0.27	0.00
2008	0.84	0.27
2009	0.89	0.75
2010	1.41	0.79
2011	0.00	0.27
2012	0.50	0.99
2013	1.41	0.27
2014	0.27	0.27
2015	0.66	0.81
2016	0.27	0.56
2017	0.69	0.00
2018	0.10	0.27
2019	0.27	0.27
2020	0.27	0.27
2021	0.27	0.27
2022	0.27	0.27
2023	0.34	0.27
2024	0.23	0.23

Source: Research’s Computation 2024

C. Interpretation and Comparison

Across both sectors:

1. Education shows extreme inequality during selective allocation years (2010, 2013), but achieves relative balance in 2018.

2. Healthcare demonstrates more episodic volatility and sharper district-specific concentration.

3. The CV analysis reveals that spatial injustice was most severe during years of:

    i. Zero allocation in one or more districts.

    ii. Highly concentrated capital surges.

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Conversely, periods of synchronized investment across districts (notably 2018 and 2019–2022) produced lower inequality levels.

Thus, the results confirm that spatial injustice in Rivers State infrastructure investment is not constant but cyclical, driven by fiscal concentration patterns rather than steady structural bias alone

D. Trend Analysis

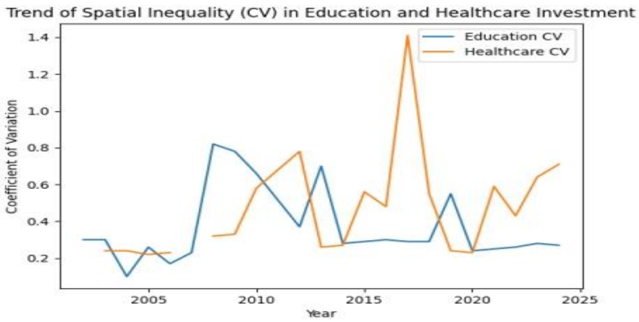

Figure 4: Trend of Coefficient of Variation for Education and Healthcare Investment (2002–2024).

Source: Research's Computation 2024

4.6.2 How to Compute CV in QGIS (Replication Steps)

Step 1: Load your attribute table containing per capita values for Rivers West, Rivers East, and Rivers South East.
Step 2: Open the Field Calculator and create a new field named MEAN_PCI using:
("RW" + "RE" + "RSE") / 3
Step 3: Create a second field STD_PCI using:
sqrt((pow("RW"-"MEAN_PCI",2) + pow("RE"-"MEAN_PCI",2) + pow("RSE"-"MEAN_PCI",2)) / 3)Step 4: Create the CV field:
"STD_PCI" / "MEAN_PCI"
Rows with MEAN_PCI = 0 should be set to NULL to avoid undefined values.

4.6.3 Spatial Inequality in Per Capita Educational Infrastructure Investment

To evaluate spatial inequality in educational infrastructure investment across Rivers State, the coefficient of variation (CV) was computed annually for real per capita educational investment in Rivers West, Rivers East, and Rivers South East between 2002 and 2024. As a standardized measure of dispersion, the CV enables comparison of inter-district equity while controlling for population differences and fluctuations in aggregate expenditure levels.

The results indicate that spatial inequality in educational investment was persistent, though its intensity varied considerably over time. While years of complete sector-wide neglect were rare, several periods recorded sharp inter-district disparities driven by uneven or zero allocations to one or more senatorial districts.

Very high inequality was observed during fiscally unstable periods, particularly in 2008, 2009, 2010, and 2013. In 2010 and 2013 especially, allocations were concentrated in a single district, producing extreme CV values and signalling acute spatial imbalance. These episodes reflect highly concentrated investment patterns that diverged markedly from population-proportional distribution.

By contrast, the period from 2014 to 2024 was characterized by relatively moderate but sustained inequality. During this phase, CV values generally clustered between approximately 0.23 and 0.30, with 2018 recording the lowest level of dispersion in the series. Although capital investment increased substantially during these years, particularly in Rivers East and Rivers West, moderate CV levels persisted. This suggests that increased fiscal commitment improved overall funding levels but did not fully eliminate structural disparities in spatial allocation.

4.6.4 Interpretation: Education Investment and Spatial Justice

From a spatial justice perspective, the coefficient of variation analysis demonstrates that educational infrastructure investment in Rivers State has exhibited patterned inequality rather than random fluctuation. Periods of extreme CV values correspond to years of selective or concentrated allocation, reflecting reactive budgeting and weak continuity in sectoral planning.

The sustained moderate inequality observed after 2014 indicates that although volatility declined, structural allocation differences remained embedded within the system. Rivers East frequently recorded higher per capita investment levels, suggesting relative prioritization of more urbanized and administratively central areas. This aligns with centre–periphery dynamics emphasized in spatial justice literature, where politically and economically central regions attract disproportionate infrastructure investment.

Conversely, Rivers South East consistently recorded lower per capita investment across most years, except during isolated rebound periods. The recurrence of comparatively lower allocations raises concerns about cumulative disadvantage and long-term disparities in educational infrastructure access and quality. Thus, even in the absence of extreme inequality, moderate but persistent imbalances can generate enduring spatial injustice.

4.6.5 Policy Implications for Educational Infrastructure

The findings highlight the necessity of institutionalizing equity-oriented planning frameworks within educational infrastructure budgeting in Rivers State. First, allocation mechanisms should incorporate transparent population-adjusted and needs-based criteria to reduce persistent inter-district disparities.

Second, multi-year investment programming must be strengthened to reduce volatility and avoid sharp concentration of resources in single fiscal cycles. Consistent medium-term planning would enhance continuity in infrastructure development and reduce reactive budgeting patterns.

Third, routine spatial monitoring of per capita investment using GIS-based indicators; such as the coefficient of variation, should be embedded within annual budget evaluation processes. Continuous monitoring would allow early identification of emerging disparities and facilitate timely corrective action. Without such reforms, educational infrastructure investment risks reinforcing structural spatial inequalities rather than advancing inclusive human capital development.

4.6.6 Spatial Inequality in Per Capita Healthcare Infrastructure Investment

To quantify spatial inequality in healthcare infrastructure investment, the coefficient of variation (CV) was similarly computed for real per capita healthcare investment across the three senatorial districts from 2002 to 2024. The CV enables assessment of how far annual allocations deviated from equitable, population-proportional distribution.

The results reveal pronounced temporal volatility and substantial spatial inequality throughout the study period. Years in which all districts recorded zero allocation (such as 2002 and 2007) represent sector-wide neglect rather than equitable distribution. In most other years, however, high CV values indicate significant inter-district disparities.

Extremely high inequality occurred during years characterized by partial or highly uneven allocation. In 2009, 2012, and 2015, for example, one district received disproportionately higher per capita investment while another recorded very low or zero allocation, resulting in elevated CV values. These years reflect severe spatial imbalance and selective fiscal concentration.

Although certain peak investment years, such as 2008 and 2018, exhibited more proportional distribution, the broader pattern remains one of instability. Unlike the education sector, healthcare investment displayed sharper swings between concentration, neglect, and partial allocation, indicating weaker continuity in planning and execution.

4.6.7 Interpretation: Healthcare Investment and Spatial Justice

The coefficient of variation analysis shows that healthcare infrastructure investment in Rivers State has been marked by chronic instability and inequity. Compared to education, healthcare funding exhibited more extreme fluctuations, with abrupt transitions between zero allocation, selective concentration, and moderate balance.

From a spatial justice standpoint, these findings suggest that healthcare infrastructure planning has been largely reactive rather than systematically anchored to population needs or service deficits. Even during years of fiscal expansion, high CV values demonstrate that increased spending alone did not guarantee equitable spatial distribution.

The persistence of disparity implies that without explicit allocation criteria grounded in equity principles, healthcare investment will continue to reproduce uneven access patterns. Spatial justice in health infrastructure requires not only greater funding but also deliberate redistribution aligned with demographic demand and infrastructural deficits.

4.6.8 Policy Implications for Healthcare Infrastructure

The findings underscore the need for equity-driven healthcare infrastructure planning reforms in Rivers State. Population-adjusted allocation rules should be formally integrated into budgeting frameworks to prevent selective concentration of capital expenditure.

Strengthening medium-term investment commitments would reduce episodic volatility and improve continuity in project delivery. Additionally, GIS-based spatial monitoring tools; including annual CV computation, should be institutionalized within budget performance review mechanisms.

Greater transparency in disaggregated capital expenditure reporting by senatorial district would further enhance accountability and reduce politicization. Without these structural reforms, healthcare infrastructure investment risks perpetuating spatial injustice rather than fostering resilient and inclusive health systems.

DISCUSSION

The results reveal persistent spatial disparities in per capita investment in both educational and healthcare infrastructure across Rivers State’s senatorial districts. While aggregate capital allocations appear substantial in certain years, population-adjusted analysis demonstrates that infrastructure investment has not been consistently equitable.

Rivers East frequently recorded higher per capita investment levels, reflecting concentration of public investment in more urbanized and administratively central areas. Rivers West occupied an intermediate position, benefiting from episodic investment surges but lacking long-term stability. Rivers South East, by contrast, exhibited comparatively lower per capita investment in multiple years, particularly during periods of fiscal contraction.

The pronounced volatility and intermittent zero allocations across both sectors point to weaknesses in budget credibility, medium-term planning, and implementation continuity. These patterns suggest that infrastructure inequities are not solely financial constraints but are embedded within governance and allocation structures.

From a spatial justice perspective, persistent per capita investment gaps constitute distributive inequity, as infrastructure provision diverges from population-based need. The evidence therefore supports the argument that spatial disparities in Rivers State infrastructure development are structurally rooted and require systemic policy reform rather than isolated fiscal adjustments (see Appendix 1 and 2).

CONCLUSION

This study assessed real per capita investment in education and healthcare infrastructure across Rivers State's three senatorial districts between 2002 and 2024. By integrating inflation-adjusted budget data, population estimates, and GIS-based spatial analysis within a spatial justice framework, the study provides a population-sensitive evaluation of infrastructure investment patterns.

The findings demonstrate that infrastructure investment has been volatile, uneven, and periodically concentrated across space. Although certain years recorded improved proportionality, persistent disparities remain evident, particularly between Rivers East and Rivers South East.

Achieving spatially just infrastructure development in Rivers State requires moving beyond aggregate expenditure figures toward institutionalized, equity-oriented, and population-adjusted allocation frameworks supported by systematic spatial monitoring.

7. Policy Implications and Recommendations

The evidence indicates that infrastructure inequities in Rivers State reflect deeper governance and distributive challenges rather than mere fiscal shortfalls. Addressing these disparities requires structural reform.

First, capital budgeting processes should formally adopt per capita and needs-based allocation criteria that integrate demographic growth, service deficits, and spatial disadvantage. This would reduce persistent underinvestment in historically disadvantaged districts.

Second, strengthening implementation of the Medium-Term Expenditure Framework (MTEF) and sectoral strategies would improve continuity and reduce volatility in infrastructure programming.

Third, enhanced transparency through publication of disaggregated capital expenditure reports by sector and senatorial district would strengthen accountability and reduce politicization of allocation decisions.

Fourth, institutionalization of GIS-based spatial analysis, such as routine computation of per capita investment and coefficient of variation indicators, would support evidence-based planning and early detection of emerging disparities.

Fifth, targeted intervention programmes should address historical infrastructure deficits in under-served districts, particularly rural and riverine communities, combining capital expansion with service quality improvement.

Finally, strengthening data systems, expenditure tracking, and inter-sectoral coordination would enhance responsiveness to localized needs and promote balanced, inclusive infrastructure development across all senatorial districts of Rivers State.

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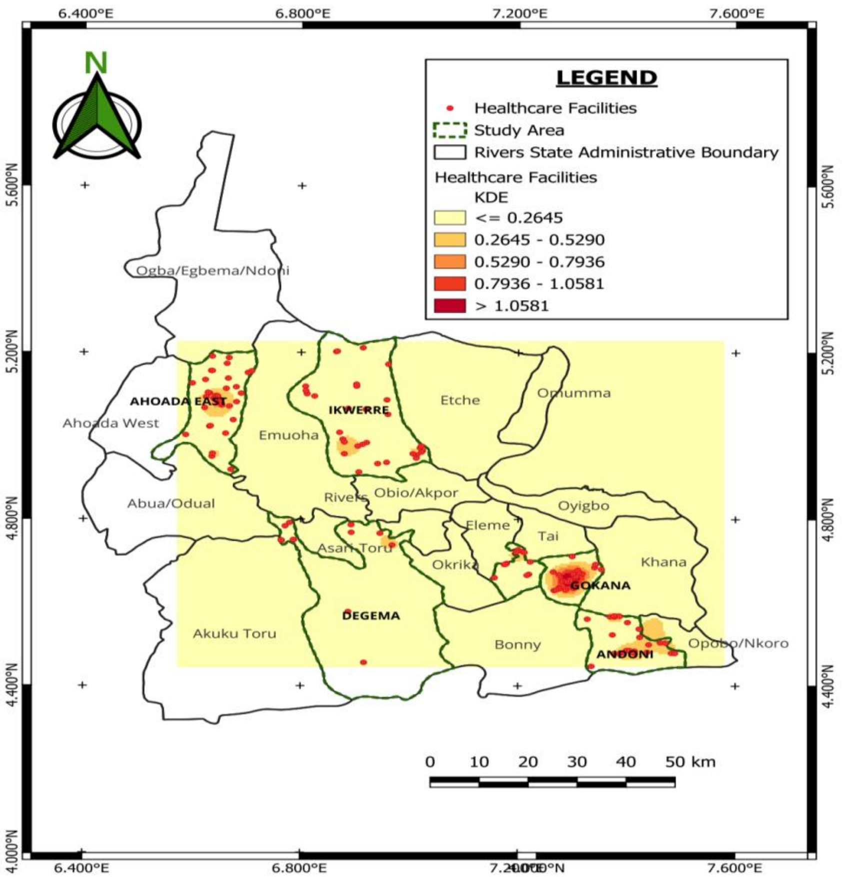
APPENDICES



Appendix 1: Kernel Density Estimation Map of Healthcare Facilities

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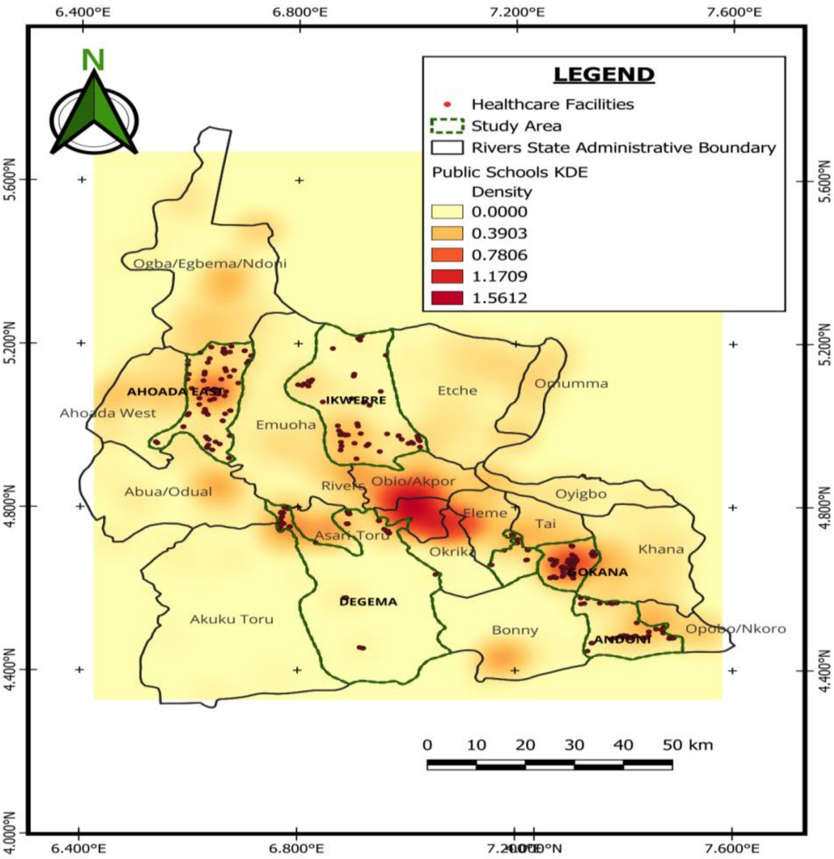

Appendix 2: Kernel Density estimation of Public School in Rivers State

Table 6: Population of the Study (selected LGAs in three senatorial districts) (2002-2024)

Year	Degema	Ahoada East	Rivers West	Ikwerre	Ogu/Bolo	RiversEast	Gokana	Andoni	Rivers South East
2002	139,378	131,721	271,099	182,252	63,480	245,732	231,782	258,071	489,853
2003	144,199	136,277	280,476	188,555	65,676	254,231	239,799	266,996	506,795
2004	149,186	140,990	290,176	195,076	67,947	263,023	248,092	276,230	524,322
2005	154,345	145,866	300,211	201,823	70,297	272,120	256,672	285,784	542,456
2006	159,683	150,910	310,593	208,803	72,728	281,531	265,549	295,667	561,216
2007	165,206	156,130	321,336	216,024	75,244	291,268	274,733	305,893	580,626
2008	170,919	161,529	332,448	223,495	77,846	301,341	284,234	316,472	600,706
2009	76,830	167,116	343,946	231,224	80,538	311,762	294,065	327,417	621,482
2010	182,946	172,895	355,841	239,221	83,323	322,544	304,235	338,741	642,976
2011	189,273	178,875	368,148	247,495	86,205	333,700	314,757	350,456	665,213

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2012	195,819	185,061	380,880	256,054	89,187	345,241	325,642	362,576	688,218
2013	202,591	191,461	394,052	264,910	92,271	357,181	336,904	375,116	712,020
2014	209,598	198,083	407,681	274,071	95,462	369,533	348,556	388,089	736,645
2015	216,847	204,934	421,781	283,550	98,764	382,314	360,611	401,511	762,122
2016	224,346	212,021	436,367	293,357	102,179	395,536	373,082	415,397	788,479
2017	232,105	219,354	451,459	303,502	105,713	409,215	385,985	429,764	815,749
2018	240,133	226,940	467,073	313,999	109,369	423,368	399,334	444,627	843,961
2019	248,437	234,789	483,226	324,858	113,152	438,010	413,145	460,004	873,149
2020	257,030	242,909	499,939	336,093	117,065	453,158	427,434	475,913	903,347
2021	265,919	251,310	517,229	347,717	121,114	468,831	442,216	492,372	934,588
2022	275,116	260,001	535,117	359,743	125,302	485,045	457,510	509,401	966,911
2023	284,630	268,993	553,623	372,184	129,636	501,820	473,333	527,018	1,000,351
2024	294,474	278,296	572,770	572,770	134,119	519,175	489,703	545,245	1,034,948

Source: Researcher’s Computation using 1991 NPC