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A Multilevel Regression Analysis of Municipal Infrastructure Asset System Efficiency in Nigeria

A 2000–2026 Methodological Evaluation

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ABSTRACT

Background: Municipal infrastructure asset systems in Nigeria face chronic inefficiencies, yet robust methodological frameworks for quantifying and analysing these inefficiencies across different administrative levels are lacking. Existing evaluations often fail to account for the hierarchical structure of data inherent in public asset management.

Purpose and objectives: This case study aims to methodologically evaluate the application of multilevel regression modelling for measuring efficiency gains within municipal infrastructure systems. The objective is to demonstrate a replicable analytical framework that isolates variance attributable to state versus local government levels.

Keywords: *Municipal infrastructure, Asset management, Multilevel modelling, Sub-Saharan Africa, Systems efficiency, Regression analysis, Public works*

Article Highlights

- Methodological demonstration of multilevel regression for infrastructure efficiency analysis
- 35% of variance in asset condition scores attributable to differences between states
- Positive but non-significant average annual trend in efficiency scores (95% CI: -0.02 to 0.08)
- Superior framework for preventing biased inference in hierarchical data structures

Methodological Contribution

Demonstrates a replicable three-level linear growth model for partitioning variance across state and local government levels in infrastructure systems.

This methodological evaluation offers a framework for analysing hierarchical infrastructure data.