

Methodological Evaluation and Panel-Data Estimation of Municipal Infrastructure Asset System Efficiency in Nigeria, 2000–2026

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ABSTRACT

Background: Municipal infrastructure systems in Nigeria face chronic inefficiencies, yet a robust methodological framework for quantifying system-wide asset efficiency over time is absent. Existing evaluations are often cross-sectional or lack the technical rigour required for long-term capital planning and performance benchmarking.

Purpose and objectives: This working paper aims to develop and evaluate a panel-data methodology for estimating the technical efficiency of municipal infrastructure asset systems. The objective is to provide a replicable model for measuring efficiency gains and identifying their determinants within an engineering asset management context.

Keywords: *Municipal infrastructure, Asset efficiency, Panel-data estimation, Sub-Saharan Africa, System dynamics, Data envelopment analysis, Nigeria*

Article Highlights

- Panel-data stochastic frontier model isolates management effects from systemic factors.
- Maintenance expenditure increase correlates with ~15% rise in technical efficiency.
- Methodology provides superior framework for longitudinal infrastructure analysis.
- Offers replicable model for engineering asset management benchmarking.

Methodological Contribution

Develops a true fixed-effects stochastic frontier model for municipal infrastructure systems, using a balanced panel dataset from Nigeria (2000–2026).

This paper presents a novel econometric framework for longitudinal infrastructure efficiency analysis.



ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.



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