

Methodological Evaluation and Panel-Data Estimation of Municipal Infrastructure System Reliability in Kenya

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ABSTRACT

Background: Municipal infrastructure systems in many developing nations face chronic reliability challenges, yet quantitative, system-level assessments remain scarce. Existing evaluations often rely on cross-sectional data, failing to capture temporal dynamics and unobserved heterogeneity across municipalities.

Purpose and objectives: This study aims to develop and apply a panel-data econometric framework to estimate the reliability of integrated municipal infrastructure systems. The objective is to quantify the influence of asset management practices, environmental stressors, and institutional factors on system-wide performance.

Keywords: *municipal infrastructure, system reliability, panel-data estimation, sub-Saharan Africa, developing economies, asset management, Kenya*

Article Highlights

- Panel-data model isolates causal drivers of infrastructure performance.
- Proactive maintenance spending shows significant positive effect on reliability.
- Informal settlement density and revenue gaps are key negative predictors.
- Methodology advances system-level assessment beyond cross-sectional snapshots.

Core Econometric Model

Two-way fixed effects: $SR_{it} = \alpha_i + \lambda_t + \beta X_{it} + \epsilon_{it}$, with inference based on cluster-robust standard errors.

This study provides a robust framework for benchmarking municipal infrastructure performance.

ABSTRACT-ONLY PUBLICATION

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