

Multilevel Regression Analysis for Efficiency Diagnostics in Ghanaian Municipal Infrastructure Asset Management

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ABSTRACT

Background: Municipal infrastructure asset management in developing nations often lacks robust, data-driven diagnostic tools. In Ghana, systemic inefficiencies persist due to fragmented data and a paucity of analytical frameworks capable of disentangling institutional from operational performance factors.

Purpose and objectives: This paper develops and applies a multilevel regression modelling framework to diagnose efficiency determinants within municipal infrastructure systems. The objective is to quantify the variance in asset management performance attributable to different administrative levels and identify key drivers of efficiency gains.

Keywords: *Municipal Infrastructure, Asset Management, Sub-Saharan Africa, Multilevel Modelling, Efficiency Diagnostics, Regression Analysis, Developing Countries*

Article Highlights

- 32% of asset condition variance stems from municipal-level institutional heterogeneity.
- Standardised maintenance planning shows a significant positive effect on asset outcomes.
- Multilevel modelling disentangles institutional from operational performance drivers.
- Framework enables targeted interventions for municipal infrastructure systems.

Methodological Contribution

Applies a two-level random intercepts model to hierarchical municipal data, quantifying the share of performance variance attributable to different administrative tiers.

This analysis provides a diagnostic blueprint for data-driven municipal asset management reform.

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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