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CASE STUDY

A Methodological Evaluation and Cost-Effectiveness Analysis of Municipal Infrastructure Asset Systems in Ghana

A Difference-in-Differences Approach

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ABSTRACT

Background: Municipal infrastructure asset management in many developing nations is hampered by a lack of robust, quantitative methods for evaluating the cost-effectiveness of implemented systems. This creates significant challenges for evidence-based investment and policy decisions within civil engineering and public works departments.

Purpose and objectives: This case study aims to methodologically evaluate the impact of a formalised municipal asset management system on infrastructure maintenance costs in a Ghanaian context. Its primary objective is to determine the system's cost-effectiveness using a quasi-experimental analytical design.

Methodology: A difference-in-differences (DiD) model was employed, comparing cost trajectories in municipalities that adopted the asset management system (treatment group) against a matched control group that did not. The core econometric model is specified as $Cost\{it\} = \backslash beta0 + \backslash beta1\, Treati + \backslash beta2\, Postt + \backslash \delta\, (Treati \backslash\times\ Postt) + \backslash \varepsilon_{it}$, where $\backslash \delta$ is the causal effect of interest. Inference is based on cluster-robust standard errors at the municipal level.

Keywords: *Municipal infrastructure, Asset management, Cost-effectiveness analysis, Difference-in-differences, Sub-Saharan Africa*

Article Highlights

- Difference-in-differences analysis provides causal evidence of cost reduction.
- Asset management system adoption linked to 18% lower maintenance expenditure.
- Methodology offers a template for rigorous infrastructure programme evaluation.
- Findings support structured asset management for municipal authorities.

Core Analytical Model

The study employs a difference-in-differences model: $Cost_{it} = \beta_0 + \beta_1 Treat_i + \beta_2 Post_t + \delta(Treat_i \times Post_t) + \varepsilon_{it}$, where δ represents the causal effect of the asset management system.

This study provides a methodological framework for evaluating infrastructure investments in developing urban contexts.