



# Methodological Evaluation of Municipal Infrastructure Assets Systems in Uganda Using Difference-in-Differences for Cost-Effectiveness Analysis

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## Abstract

This study addresses a current research gap in Engineering concerning Methodological evaluation of municipal infrastructure assets systems in Uganda: difference-in-differences model for measuring cost-effectiveness in Uganda. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A mixed-methods design was used, combining survey and interview data collected over the study period. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of municipal infrastructure assets systems in Uganda: difference-in-differences model for measuring cost-effectiveness, Uganda, Africa, Engineering, original research This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Uganda, GIS, M&E, econometrics, DID, asset management, cost-benefit analysis

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