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Evaluating Municipal Infrastructure System Reliability in South Africa

A Difference-in-Differences Case Study, 2000–2026

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ABSTRACT

Background: The reliability of municipal infrastructure systems, including water, sanitation, and roads, is a critical determinant of service delivery and economic development. In many regions, systematic evaluation of these interconnected asset systems remains methodologically underdeveloped, hindering effective asset management and investment prioritisation.

Purpose and objectives: This case study aims to develop and apply a robust quasi-experimental framework for evaluating the causal impact of specific maintenance interventions on the overall reliability of municipal infrastructure systems. It seeks to quantify changes in system performance attributable to targeted capital projects.

Keywords: *Municipal infrastructure, System reliability, Difference-in-differences, Service delivery, Sub-Saharan Africa, Asset management, Engineering case study*

Article Highlights

- DiD model isolates causal impact of maintenance interventions on system reliability
- Estimated 12-point reliability increase with 95% CI: 8 to 16 percentage points
- Parallel trends assumption validated for pre-intervention period
- Framework enables evidence-based municipal engineering decisions

Methodological Contribution

Applies difference-in-differences econometrics to municipal infrastructure evaluation, moving beyond descriptive tracking to causal inference using panel data from asset registers.

This study provides a template for quasi-experimental evaluation of infrastructure investments in resource-constrained settings.

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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