

Methodological Evaluation and Panel-Data Estimation for Municipal Infrastructure Risk Reduction in South Africa, 2000–2026

Thandiwe Nkosi¹, Kagiso Mokoena^{2,3}, Pieter van der Merwe^{2,3}
Anesh Singh^{2,4}

Department of Sustainable Systems, Agricultural Research Council (ARC) | University of the Free State | Wits
Business School | Agricultural Research Council (ARC)

Correspondence: tnkosi@yahoo.com

Received: 12 May 2024 | Accepted: 03 July 2024 | Published: 18 August 2024 | DOI: [10.5281/zenodo.18971503](https://doi.org/10.5281/zenodo.18971503)

ABSTRACT

Background: Municipal infrastructure in South Africa faces systemic challenges, with asset management systems often lacking robust, data-driven methodologies for quantifying risk reduction. This impedes effective policy formulation and resource allocation for critical engineering assets.

Purpose and objectives: This policy analysis evaluates methodological approaches for infrastructure asset systems and develops a panel-data econometric model to estimate the efficacy of municipal interventions in reducing infrastructure risk.

Keywords: *Municipal infrastructure, Risk reduction, Panel-data estimation, Asset management systems, Sub-Saharan Africa*

Article Highlights

- Methodological critique identifies over-reliance on static condition assessments in current asset management.
- Panel-data model reveals significant link between preventative expenditure and reduced infrastructure risk.
- A one-standard-deviation spending increase correlates with a 12–18% decrease in the risk index.
- Advocates for national policy mandating standardised longitudinal data collection.

Core Econometric Specification

Two-way fixed effects model: $Risk_{it} = \beta_0 + \beta_1 Intervention_{it} + \alpha_i + \lambda_t + \varepsilon_{it}$, with municipality (α_i) and year (λ_t) fixed effects. Inference uses cluster-robust standard errors.

This analysis provides a novel framework for evaluating infrastructure policy efficacy over time.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

REQUEST FULL PAPER

 **Email:** info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

**Are you a researcher in Africa? We
welcome your submissions!**

Join our community of African scholars and share
your groundbreaking work.

 **Submit at:** app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global
Knowledge