

Methodological Evaluation and Panel-Data Estimation for Municipal Infrastructure Asset Yield in Rwanda, 2000–2026

Jean de Dieu Niyonzima^{1,2} | Marie Claire Uwimana^{3,4}

Jean Paul Habimana⁵

¹ University of Rwanda

² African Leadership University (ALU), Kigali

³ Department of Civil Engineering, African Leadership University (ALU), Kigali

⁴ Rwanda Environment Management Authority (REMA)

⁵ Department of Sustainable Systems, African Leadership University (ALU), Kigali

Correspondence: jniyonzima@gmail.com

Received: 03 October 2012 | Accepted: 10 November 2012 | Published: 08 January 2013 | DOI:

[10.5281/zenodo.18966715](https://doi.org/10.5281/zenodo.18966715)

ABSTRACT

Background: Municipal infrastructure asset management in developing economies often lacks robust, data-driven methodologies for performance forecasting. Existing approaches frequently rely on cross-sectional data, failing to capture temporal dynamics and unobserved heterogeneity, which limits the accuracy of long-term yield projections for critical engineering assets.

Purpose and objectives: This study aims to methodologically evaluate panel-data estimation techniques for modelling the yield of municipal infrastructure assets. The primary objective is to develop and validate a model that quantifies improvement in asset performance over time, providing a tool for strategic investment and maintenance planning.

Keywords: *Municipal infrastructure, Asset management, Panel-data estimation, Sub-Saharan Africa, Developing economies, Yield improvement, Performance forecasting*

Article Highlights

- Two-way fixed effects model controls for unobserved heterogeneity and temporal shocks.
- Targeted maintenance shows strong, direct association with yield improvement (coefficient: 0.18).
- Model provides reliable framework for strategic investment and maintenance planning.
- Study demonstrates applicability of panel-data methods in Sub-Saharan African context.

Core Analytical Model

Two-way fixed effects specification: $Y_{it} = \alpha + \beta X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$, with robust standard errors clustered at asset level.

This study provides a validated methodological framework for infrastructure performance forecasting in developing economies.

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