AFRICAN CIVIL ENGINEERING JOURNAL
Vol. 1 | No. 1 | 2025 | 10.5281/zenodo.18970066

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

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Received: 12 May 2025 | Accepted: 26 July 2025 | Published: 23 August 2025 | **DOI:** 10.5281/zenodo.18970066

ABSTRACT

Background: Municipal infrastructure asset management in developing nations often lacks robust, data-driven methodologies for performance forecasting. This creates significant challenges for capital planning and maintenance prioritisation, particularly in sub-Saharan Africa where empirical longitudinal data is scarce.

Purpose and objectives: This case study aims to methodologically evaluate existing municipal asset management systems and to develop a panel-data estimation model for forecasting infrastructure asset yield. The objective is to provide a replicable framework for measuring potential yield improvements in water supply and road networks.

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

Article Highlights

- Methodological evaluation reveals systemic gaps, with over 60% of municipal asset registers incomplete.
- Panel-data model shows a statistically significant positive relationship between maintenance spending and yield.
- The study provides a replicable framework for forecasting infrastructure performance in developing economies.
- Findings underscore the critical need for standardised longitudinal data in municipal asset management.

Core Econometric Model

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

This study addresses a critical gap in data-driven infrastructure management for sub-Saharan Africa.