

AFRICAN STRUCTURAL ENGINEERING

ISSN: XXXX-XXXX | Peer-Reviewed | Open Access

A Quasi-Experimental Framework for Efficiency Diagnostics in Nigerian Municipal Infrastructure Asset Management

DOI: [10.5281/zenodo.18966826](https://doi.org/10.5281/zenodo.18966826) | Received: 31 December 2025 | Accepted: 12 March 2026 |
Published: 24 April 2026

Chinelo Okonkwo¹|Tunde Olawale^{2,3}|Adebayo Adeyemi^{4,5}
Ngozi Eze^{6,7}

¹ Ahmadu Bello University, Zaria

² Department of Civil Engineering, Agricultural Research Council of Nigeria (ARCN)

³ Department of Electrical Engineering, University of Maiduguri

⁴ Department of Mechanical Engineering, Ahmadu Bello University, Zaria

⁵ Agricultural Research Council of Nigeria (ARCN)

⁶ Bayero University Kano

⁷ University of Maiduguri

Correspondence: cokonkwo@outlook.com

DOI: [10.5281/zenodo.18966826](https://doi.org/10.5281/zenodo.18966826)

Received: 31 December 2025 | Accepted: 12 March 2026

ABSTRACT

Background: Municipal infrastructure asset management in Nigeria is characterised by systemic inefficiencies and a lack of robust diagnostic tools. Current evaluation methods often rely on descriptive analyses, which fail to isolate the causal impact of management interventions on asset performance.

Purpose and objectives: This article presents a novel quasi-experimental framework designed to measure efficiency gains within municipal infrastructure systems. Its primary objective is to provide a rigorous methodological tool for diagnosing causal improvements in asset management practices.

Keywords: *Municipal infrastructure, Asset management, Quasi-experimental design, Efficiency diagnostics, Sub-Saharan Africa, Systems evaluation, Engineering methodology*

Article Highlights

- Proposes a difference-in-differences design to isolate causal effects in asset management.
- Framework enables detection of a 15% minimum improvement in asset condition with 80% power.
- Distinguishes genuine programme effects from underlying secular trends in system performance.
- Provides a viable alternative to randomized trials where they are impractical in engineering contexts.

Core Statistical Model

The analysis employs a fixed-effects panel regression: $Y_{it} = \alpha + \beta(\text{Treat}_i \times \text{Post}_t) + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$, with inference based on cluster-robust standard errors.

This is a methodology article presenting a novel framework, not empirical results from a field application.

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