AFRICAN STRUCTURAL ENGINEERING

WORKING PAPER

A Quasi-Experimental Design for Cost-Effectiveness Diagnostics of Water Treatment Systems in Rwanda (2000–2026)

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ABSTRACT

Background: Evaluating the long-term cost-effectiveness of water treatment infrastructure in low-resource settings remains a significant methodological challenge, particularly for isolating the causal impact of specific interventions from confounding factors.

Purpose and objectives: This working paper presents a novel quasi-experimental design to diagnose the cost-effectiveness of water treatment systems. The primary objective is to provide a robust methodological framework for engineers and policymakers to assess the financial and operational efficiency of such infrastructure.

Keywords: *Quasi-experimental design, Cost-effectiveness analysis, Water treatment systems, Sub-Saharan Africa, Infrastructure evaluation, Development engineering*

Article Highlights

- Proposes a novel difference-in-differences framework for infrastructure evaluation.
- Addresses the challenge of isolating causal impact from confounding factors.
- Designed for application in low-resource, real-world engineering contexts.
- Aims to provide actionable diagnostics for policymakers and engineers.

Core Statistical Model

The analysis employs a district-level DiD model: $Y_t = \beta_0 + \beta_1 Treat_t + \beta_2 Post_t + \beta_3 (Treat \times Post)_t + \gamma X_t + \varepsilon_t$, where Y is the cost-effectiveness ratio.

This is a methodological paper; full empirical results from the 2000–2026 study are forthcoming.