AFRICAN STRUCTURAL ENGINEERING

METHODOLOGY PAPER

Randomised Field Trial for the Performance Diagnostics and Yield Optimisation of Water Treatment Facilities in Senegal

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ABSTRACT

Background: Water treatment facilities in many regions face operational inefficiencies, leading to suboptimal yield and unreliable supply. Systematic, field-based diagnostic methodologies are required to move beyond theoretical modelling and identify actionable improvements under real-world conditions.

Purpose and objectives: This article presents a novel methodological framework for conducting a randomised field trial to diagnose performance bottlenecks and quantify yield optimisation in water treatment facilities. The objective is to provide a replicable protocol for empirical, evidence-based facility evaluation.

Keywords: *Randomised controlled trial, Performance diagnostics, Yield optimisation, Sub-Saharan Africa, Water treatment facilities, Process evaluation, Field-based methodology*

Article Highlights

- Presents a replicable protocol for empirical, evidence-based facility evaluation.
- Methodology structured to detect a minimum yield improvement of 15 percentage points.
- Analytical framework powered to distinguish treatment effects from facility-level variability.
- Advocates for moving beyond theoretical modelling to actionable, real-world improvements.

Core Analytical Model

Generalised linear mixed model: $Y_{ij} = \beta 0 + \beta 1 T_{ij} + \mu_i + \varepsilon_{ij}$, with robust standard errors to account for heteroskedasticity.

This is a methodology article presenting a trial design and analytical framework.