

CASE STUDY

Quasi-Experimental Diagnostics of Water Treatment Efficiency Gains in Senegal

A Case Study (2000–2026)

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ABSTRACT

Background: Evaluating the impact of large-scale infrastructure interventions in developing contexts presents significant methodological challenges. Traditional engineering assessments often lack robust counterfactuals, making it difficult to attribute observed performance changes solely to the intervention.

Purpose and objectives: This case study aimed to develop and apply a quasi-experimental design to rigorously diagnose efficiency gains from a national programme of water treatment facility upgrades. The objective was to isolate the causal effect of the technological interventions from confounding temporal and regional factors.

Keywords: *Quasi-experimental design, Water treatment efficiency, Sub-Saharan Africa, Infrastructure evaluation, Engineering case study, Process diagnostics*

Article Highlights

- Difference-in-differences framework isolates causal effects from confounding factors.
- Upgraded facilities achieved 22% greater turbidity reduction versus control group.
- Methodology proves viable for real-world engineering performance evaluation.
- Recommends quasi-experimental frameworks for ex-post infrastructure assessment.

Core Analytical Framework

The study employed a difference-in-differences model: $Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta(\text{Treat}_i \times \text{Post}_t) + \varepsilon_{it}$, where δ captures the causal effect of the technological upgrades, with inference based on cluster-robust standard errors.

This case study demonstrates a rigorous methodological approach to evaluating infrastructure interventions in developing contexts.

ABSTRACT-ONLY PUBLICATION

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