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A Difference-in-Differences Framework for Evaluating Water Treatment System Yield in Senegal (2000–2026)

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Aïssatou Diop¹|Fatou Sarr^{1,2}|Mamadou Ndiaye³

¹ Institut Pasteur de Dakar

² Department of Civil Engineering, Council for the Development of Social Science Research in Africa (CODESRIA), Dakar

³ Department of Civil Engineering, African Institute for Mathematical Sciences (AIMS) Senegal

Correspondence: adiop@aol.com

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ABSTRACT

Background: Evaluating the performance of large-scale water treatment infrastructure in developing regions requires robust methods to isolate the causal effect of interventions from confounding temporal trends. Existing engineering assessments often lack rigorous counterfactual analysis.

Purpose and objectives: This article presents a methodological framework for quantifying the causal impact of infrastructure upgrades on system yield. The objective is to provide a replicable, quasi-experimental approach for engineers and planners to assess intervention efficacy.

Keywords: *difference-in-differences, water treatment yield, infrastructure evaluation, Sub-Saharan Africa, causal inference, engineering methodology, Senegal*

Article Highlights

- Presents a formalised DiD econometric technique for water treatment yield assessment.
- Illustrates a hypothetical scenario identifying a 15% yield improvement from retrofits.
- Recommends panel data collection from both intervention and control facilities.
- Provides a replicable approach for causal inference in engineering contexts.

Core Model Specification

$Y_{it} = \beta_0 + \beta_1 \text{Treat}_i + \beta_2 \text{Post}_t + \delta(\text{Treat}_i \cdot \text{Post}_t) + \varepsilon_{it}$, where δ is the causal estimand of interest.

This is a methodology article presenting a framework, not empirical results.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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