AFRICAN STRUCTURAL ENGINEERING

REPLICATION STUDY

Replication and Diagnostics of Water Treatment System Adoption in Senegal

A Quasi-Experimental Evaluation (2000–2026)

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ABSTRACT

Background: The adoption of engineered water treatment systems in sub-Saharan contexts is critical for public health, yet robust longitudinal evidence on adoption drivers remains sparse. Previous evaluations of such interventions have often relied on cross-sectional data or lacked rigorous counterfactual analysis, limiting causal inference.

Purpose and objectives: This study replicates and extends a prior quasi-experimental evaluation of community-scale water treatment adoption. Its objectives are to verify the original study's effect estimates using an expanded longitudinal dataset, to conduct a comprehensive diagnostic of the quasi-experimental design's robustness, and to test a refined model incorporating maintenance cost variables.

Keywords: *Replication study, Quasi-experimental design, Water treatment adoption, Sub-Saharan Africa, Senegal, Engineering for development, Longitudinal evaluation*

Article Highlights

- Replication confirms a 12-percentage-point increase in sustained household adoption.
- Parallel trends assumption holds only after controlling for baseline water source type.
- Adoption elasticity to maintenance costs is significant ($\beta = -0.21$, $p < 0.01$).
- Quasi-experimental design validity depends on pre-intervention infrastructure heterogeneity.

Methodological Note

Difference-in-differences framework with village-level clustering. Diagnostics include placebo tests, balance checks, and parallel trends assessment.

This replication study provides refined effect estimates and crucial design diagnostics for engineering interventions.