

Replication and Methodological Evaluation of Water Treatment System Reliability in Tanzania

A Difference-in-Differences Analysis

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ABSTRACT

Background: Ensuring the reliability of water treatment systems is a critical engineering challenge in sub-Saharan Africa. Previous studies have employed various analytical frameworks to assess performance, but the robustness of causal inference methods, particularly difference-in-differences (DiD) models, in this context requires further validation.

Purpose and objectives: This study aims to replicate and methodologically evaluate a prior DiD analysis of water treatment system reliability. The objectives are to assess the model's specification, identify potential biases, and verify the robustness of the original findings using the same dataset.

Keywords: *Replication study, Water treatment reliability, Sub-Saharan Africa, Difference-in-differences, Methodological evaluation, Engineering systems*

Article Highlights

- Replication confirms significant positive effect under original model specification.
- Effect size attenuates by ~40% with inclusion of time-varying covariates.
- Findings underscore need for rigorous robustness checks in DiD applications.
- Highlights methodological challenges in causal inference for infrastructure.

Core Finding

The coefficient β_3 for the intervention effect was estimated at 0.15 (95% CI: 0.08, 0.22) in the base model, but proved sensitive to specification.

This replication study critically examines the methodological robustness of a prior causal analysis.

ABSTRACT-ONLY PUBLICATION

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