

AFRICAN CIVIL ENGINEERING JOURNAL

ISSN: XXXX-XXXX | Peer-Reviewed | Open Access

A Difference-in-Differences Framework for Reliability Diagnostics in Senegalese Water Treatment Systems (2000–2026)

DOI: [10.5281/zenodo.18965517](https://doi.org/10.5281/zenodo.18965517) | Received: 04 February 2016 | Accepted: 31 May 2016 |

Published: 24 June 2016

Fatou Ndiaye^{1,2} | Moussa Sarr^{1,3} | Aminata Diop³

Idrissa Diallo⁴

¹ African Institute for Mathematical Sciences (AIMS) Senegal

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

³ Cheikh Anta Diop University (UCAD), Dakar

⁴ Department of Sustainable Systems, African Institute for Mathematical Sciences (AIMS) Senegal

Correspondence: fndiaye@yahoo.com

DOI: [10.5281/zenodo.18965517](https://doi.org/10.5281/zenodo.18965517)

Received: 04 February 2016 | Accepted: 31 May 2016

ABSTRACT

Background: The reliability of water treatment infrastructure in sub-Saharan Africa is a critical engineering challenge, yet robust quantitative frameworks for its longitudinal assessment are lacking. Existing evaluations often rely on cross-sectional data or descriptive statistics, which fail to isolate the causal impact of specific interventions or stressors on system performance.

Purpose and objectives: This article presents a novel methodological framework for diagnosing the reliability of water treatment systems. Its objective is to provide engineers and planners with a rigorous, quasi-experimental tool to quantify the effect of maintenance programmes, upgrades, or external shocks on key performance indicators.

Keywords: *Difference-in-differences, Reliability engineering, Water treatment systems, Sub-Saharan Africa, Infrastructure diagnostics, Longitudinal analysis, Senegal*

Article Highlights

- Adapts econometric difference-in-differences model for engineering reliability diagnostics.
- Provides a quasi-experimental tool to isolate causal impacts of interventions or stressors.
- Controls for seasonal variations and regional baseline differences in performance.
- Enables rigorous evaluation of maintenance programmes, upgrades, and external shocks.

Core Model

$Y_{it} = \alpha + \beta (\text{Treatment}_i \times \text{Post}_t) + \gamma_i + \delta_t + \epsilon_{it}$, where β captures the causal effect on reliability metric Y .

A pilot application indicated a measurable positive effect of a targeted maintenance protocol.

ABSTRACT-ONLY PUBLICATION

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

REQUEST FULL PAPER

 **Email:** info@parj.africa

Request your copy of the full paper today!

SUBMIT YOUR RESEARCH

**Are you a researcher in Africa? We
welcome your submissions!**

Join our community of African scholars and share
your groundbreaking work.

 **Submit at:** app.parj.africa



Scan to visit app.parj.africa

Open Access Scholarship from PARJ

Empowering African Research | Advancing Global
Knowledge