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A Comparative Quasi-Experimental Evaluation of Water Treatment System Yield in Rwanda (2000–2026)

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Marie Claire Uwase[1,2] | **Jean de Dieu Uwimana**[2,3]

[1] *African Leadership University (ALU), Kigali*

[2] *University of Rwanda*

[3] *Department of Mechanical Engineering, African Leadership University (ALU), Kigali*

Correspondence: muwase@aol.com

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ABSTRACT

Background: The sustainable operation of water treatment infrastructure in developing regions requires robust methods for evaluating system performance. In Rwanda, assessing the yield—the ratio of treated water output to raw water input—of existing facilities is critical for infrastructure planning and investment, yet longitudinal comparative studies are scarce.

Purpose and objectives: This study aims to methodologically evaluate and compare the operational yield of different water treatment system types in Rwanda using a quasi-experimental design, identifying factors that significantly influence long-term yield improvement.

Keywords: *Water treatment, Quasi-experimental design, System yield, Sub-Saharan Africa, Performance evaluation, Sustainable infrastructure, Rwanda*

Article Highlights

- Dissolved air flotation systems showed a significant mean yield improvement of 12.3 percentage points.
- Performance differential was most pronounced during periods of high rainfall and variable raw water quality.
- The study provides a robust methodological framework for isolating technology effects from operational confounders.
- Findings underscore the need for technology selection resilient to source water fluctuations.

Methodological Note

Employed a comparative quasi-experimental design with fixed-effects panel regression on longitudinal data from matched pairs of treatment facilities.

This study offers evidence-based guidance for water infrastructure investment in Rwanda and similar contexts.