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Methodological Evaluation of Water Treatment Facilities Systems in Rwanda Using Quasi-Experimental Design to Measure System Reliability

Rutagwenda Bizimana[1], **Uwilinginyewa Gaterera**[2], **Kabwandanda Ndayishimiye**[3,4], **Nyirabye Habilu**[1,5]

[1] Rwanda Environment Management Authority (REMA)

[2] University of Rwanda

[3] Department of Civil Engineering, University of Rwanda

[4] Department of Mechanical Engineering, Rwanda Environment Management Authority (REMA)

[5] Department of Civil Engineering, Rwanda Environment Management Authority (REMA)

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Correspondence: rbizimana@hotmail.com

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Author notes

Rutagwenda Bizimana is affiliated with Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

Uwilinginyewa Gaterera is affiliated with University of Rwanda and focuses on Engineering research in Africa.

Kabwandanda Ndayishimiye is affiliated with Department of Civil Engineering, University of Rwanda and focuses on Engineering research in Africa.

Nyirabye Habilu is affiliated with Department of Civil Engineering, Rwanda Environment Management Authority (REMA) and focuses on Engineering research in Africa.

Abstract

The water treatment facilities in Rwanda face challenges related to system reliability due to varying operational conditions. A quasi-experimental design was employed, including data collection from 30 randomly selected water treatment plants across Rwanda over a period of one year. Statistical analysis used linear regression models to assess system performance. System failure rates were found to be significantly higher during rainy seasons compared to dry periods ($p < 0.05$). The quasi-experimental design provided robust insights into the reliability of water treatment systems in Rwanda, highlighting seasonal variations in system stability. Continuous monitoring and maintenance strategies should be implemented during rainy seasons to enhance system reliability. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Africa, Ethical, Heterogeneous, SystemsAnalysis, Qualitative, ExperimentalDesign*