



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

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## 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  $Y = \beta_0 + \beta_1 X + u_i + \varepsilon_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Sub-Saharan, Africa, Ethical, Heterogeneous, Systems Analysis, Qualitative, Experimental Design

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