



# Multilevel Regression Analysis for Evaluating Water Treatment Facility Efficiency in Nigeria: A Replication Study

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## Abstract

Water treatment facilities in Nigeria face challenges related to efficiency due to varying levels of infrastructure quality and operational management. A multilevel logistic regression model was employed to analyse the impact of various factors at both individual facilities (level 1) and regional context (level 2) on operational efficiency. The study utilised data from Nigerian water management authorities over a five-year period. The analysis revealed that facility-level variables, such as maintenance frequency and staff training, significantly influenced treatment efficacy, with a coefficient of -0.53 for maintenance frequency in the multilevel model (95% CI: -1.02 to -0.04). This study confirms the effectiveness of multilevel regression analysis in assessing water treatment facility efficiency and highlights the importance of consistent monitoring and support at both local and regional levels. Policy recommendations include prioritising maintenance investments, enhancing staff training programmes, and implementing regular quality control measures to improve overall facility performance. The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + \text{varepsilon}_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Nigerian, multilevel, logistic, regression, evaluation, infrastructure, management

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