African Agricultural Systems Engineering

Multilevel Regression Analysis for Measuring Risk Reduction in Water Treatment Facilities Systems in Tanzania: An Engineering Perspective

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Abstract

Water treatment facilities in Tanzania face risks that can impact their functionality and efficiency. Multilevel regression analysis was employed to assess the effectiveness of various risk mitigation measures across different levels of the system. The analysis revealed a significant reduction in operational risks by up to 20% when preventive maintenance protocols were implemented at the facility level, with robust standard errors indicating reliability. The multilevel regression model provided insights into optimising risk management strategies for water treatment facilities in Tanzania. Implementing targeted maintenance programmes and regular system audits are recommended to further enhance risk reduction effectiveness. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, regression analysis, multilevel modelling, water resources management, epidemiology, public health engineering, stochastic processes*

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