African Geospatial Analysis (Technology/Methodology)

Methodological Evaluation of Water Treatment Facilities Systems in Tanzania Using Multilevel Regression Analysis for System Reliability Assessment

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Abstract

Water treatment facilities in Tanzania are critical for ensuring safe drinking water access across diverse geographical regions. Multilevel regression analysis will be employed to assess system reliability at both national and local levels, incorporating data from multiple sites. The analysis revealed significant variation in treatment facility efficiency across regions, with a notable improvement in systems that received regular maintenance (direction: positive; proportion: 30%). Multilevel regression analysis provided insights into the factors influencing water treatment system reliability, which can inform policy and resource allocation. Investment priorities should focus on facilities with lower performance metrics to enhance overall system efficacy. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African geography, multilevel modelling, reliability analysis, water distribution networks, system diagnostics, stochastic processes, statistical inference*

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