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

Sunday Ogbonna[1]

[1] University of Benin

Author notes

Sunday Ogbonna is affiliated with University of Benin and focuses on Engineering research in Africa.

Abstract

Water treatment facilities in Nigeria face significant challenges due to varying water quality and infrastructure conditions. Multilevel regression analysis was applied to assess the reliability of water treatment systems across different levels of geographical distribution. The analysis revealed that facility age had a significant negative impact on system performance, with older facilities showing a decline in efficiency by up to 20% compared to newer ones (95% CI: -18.5% to -23.6%). Multilevel regression analysis provided insights into the reliability of water treatment systems and identified age as an important factor. Investment in maintenance and upgrading older facilities is recommended to improve system reliability. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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