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Multilevel Regression Analysis for Evaluating Cost-Effectiveness in Municipal Infrastructure Asset Systems in Tanzania

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Abstract

Municipal infrastructure asset systems in Tanzania face challenges related to maintenance costs and service quality. A multilevel regression model was employed to analyse the impact of various factors on asset systems' efficiency and costs. The data were collected from 10 urban municipalities in Tanzania over a three-year period. The multilevel regression analysis revealed that investment in preventive maintenance significantly reduced repair costs by an average of 25% (95% CI: -30, -20) compared to reactive maintenance strategies. Micro-level data highlighted the importance of local community engagement for improved asset utilization. The study provides a robust framework for assessing municipal infrastructure cost-effectiveness and offers evidence-based recommendations for policy makers. Policy makers should prioritise investment in preventive maintenance and encourage community participation to enhance the efficiency and longevity of municipal assets. Municipal Infrastructure, Cost-Effectiveness, Multilevel Regression Analysis, Tanzania The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Multilevel regression, Tanzania, Asset management, Cost-effectiveness, Hierarchical analysis, Quantitative methods, Geographic information systems*

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