



# Methodological Evaluation of Municipal Infrastructure Asset Systems in Tanzania: A Randomized Field Trial for System Reliability Assessment

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## Abstract

Municipal infrastructure asset systems in Tanzania are critical for urban development and service delivery. However, their reliability is often compromised due to inadequate maintenance and management. A randomized field trial was conducted across five municipalities with varying levels of asset management practices. A mixed-effects logistic regression model was employed to assess the impact of maintenance frequency, funding availability, and community engagement on system reliability. Uncertainty in estimates was quantified using robust standard errors. The study revealed that a higher proportion (65%) of municipal assets were reliably maintained when regular inspection schedules were implemented compared to those without such protocols. This randomized field trial provides evidence for the effectiveness of preventive maintenance strategies in enhancing system reliability. The mixed-effects logistic regression model effectively captured the interplay between management practices and asset performance. Implementing regular inspection schedules, increasing funding allocation for maintenance, and fostering community engagement are recommended to improve municipal infrastructure reliability in Tanzania. The maintenance outcome was modelled as  $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** Tanzania, GIS, Monte Carlo simulation, Life cycle assessment, Network theory, Data mining, Randomized controlled trial



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