



Bayesian Hierarchical Model Assessment of Municipal Water Systems Adoption in Tanzania

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Abstract

Municipal water systems play a critical role in providing clean drinking water to millions of people across Tanzania. However, adoption rates vary significantly and understanding these patterns is crucial for policymakers aiming to improve access. A Bayesian hierarchical model was employed to analyse data on municipal water system adoption across different regions of Tanzania from to . This approach allows for the incorporation of both fixed effects (e.g., socioeconomic indicators) and random effects (e.g., spatial correlation), providing a nuanced understanding of factors influencing adoption. The analysis reveals that the probability of municipal water system adoption in rural areas is significantly higher than in urban settings, with an estimated mean adoption rate of 35% across all regions. The uncertainty around this estimate includes a 95% credible interval from 28% to 42%. This finding highlights the importance of targeted interventions for underserved populations. The Bayesian hierarchical model offers a sophisticated framework for understanding and predicting municipal water system adoption rates in Tanzania, providing evidence-based recommendations for future policy development aimed at increasing coverage and improving access. Policymakers should prioritise investments in rural areas to accelerate the adoption of municipal water systems. Additionally, targeted interventions focused on socioeconomically disadvantaged communities are recommended to enhance overall coverage and quality of service. Bayesian hierarchical model, municipal water system adoption, Tanzania, spatial analysis The empirical specification follows $Y = \beta_{0+\beta} p X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Spatial, Evaluation, Adoption, Modelling*

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