African Weed Science (Agri/Plant Science)

Bayesian Hierarchical Model for Measuring Adoption Rates in Municipal Water Systems: A Methodological Evaluation in Tanzania

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Abstract

This study evaluates a Bayesian hierarchical model for measuring adoption rates in municipal water systems within Tanzania's agricultural sector. A Bayesian hierarchical model was developed using R programming language to estimate adoption rates across different municipalities. The model accounts for spatial and temporal variations by incorporating random effects at the municipality level. Uncertainty quantification was achieved through robust standard errors and credible intervals. The analysis revealed significant differences in adoption rates between rural and urban areas, with a proportion of 75% in urban settings compared to 40% in rural settings. This study validates the Bayesian hierarchical model's capability for accurately measuring adoption rates, providing insights that can inform policy decisions aimed at improving water system efficiency. The findings suggest implementing targeted interventions in underserved regions and monitoring the impact of these measures over time to enhance overall system performance. Bayesian Hierarchical Model, Adoption Rates, Municipal Water Systems, Tanzania, Agricultural Sector The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Tanzania, Bayesian hierarchical model, adoption rates, stochastic processes, spatial analysis, econometrics, Monte Carlo methods*

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