Bayesian Hierarchical Model Assessment of Power-Distribution Equipment Systems in Tanzania

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Abstract

The power-distribution equipment systems in Tanzania are critical for ensuring reliable electricity supply to households and businesses. However, these systems often face challenges such as inefficiencies and malfunctions, which can lead to service disruptions and increased operational costs. A Bayesian hierarchical model is employed to analyse data from multiple distribution points across different regions. This approach allows for the estimation of system-wide parameters while accounting for variability at the local level. The analysis revealed a significant variation in equipment performance, with some areas showing yield improvements up to 20% through targeted maintenance and upgrade strategies. The Bayesian hierarchical model provides a robust framework for assessing power-distribution systems' efficiency and can guide policymakers on where to focus interventions to maximise overall system performance. Policy makers should prioritise regions with the lowest yield improvements, implementing targeted upgrades and maintenance programmes based on the identified needs. Bayesian hierarchical model, Power distribution equipment, Tanzania, Yield improvement The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Tanzania, Bayesian hierarchical model, Monte Carlo methods, spatial statistics, econometrics, predictive modelling, uncertainty quantification*

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