Bayesian Hierarchical Model for Measuring Adoption Rates of Power-Distribution Equipment Systems in Kenya

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Abstract

The adoption of power-distribution equipment systems (PDES) in Kenya has been inconsistent, with varying rates across different regions and sectors. A Bayesian hierarchical model was employed to analyse data from multiple regions in Kenya. The model accounts for spatial and temporal variation, with parameters estimated using Markov Chain Monte Carlo methods. The analysis revealed a significant spatial gradient in PDES adoption rates, with urban areas showing higher adoption compared to rural regions. This study demonstrates the effectiveness of Bayesian hierarchical models in improving the accuracy of adoption rate measurements for complex systems across diverse environments. Policymakers should prioritise infrastructure development and targeted interventions in underserved regions to accelerate PDES adoption rates. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenya, Bayesian Hierarchical Model, Power-Distribution Equipment Systems, Methodological Evaluation, Geographic Analysis, Statistical Modelling, Spatial Statistics*

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