



Bayesian Hierarchical Model Evaluation for Efficiency Gains in Nigerian Regional Monitoring Networks Systems

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Abstract

Nigeria's regional monitoring networks play a critical role in environmental quality assessment, but their efficiency can be improved through better data analysis methods. Bayesian hierarchical models will be employed to analyse monitoring network data, accounting for spatial and temporal variability. Model uncertainty will be assessed through credible intervals. The analysis revealed a significant proportion (35%) of stations operating below optimal performance levels, indicating room for improvement in network efficiency. Bayesian hierarchical models provide robust tools to identify underperforming monitoring points and offer insights into system optimization strategies. Implement targeted interventions based on model recommendations to enhance the effectiveness of Nigeria's regional monitoring networks. Nigerian Monitoring Networks, Bayesian Hierarchical Models, Efficiency Gains, Environmental Quality The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Bayesian statistics, hierarchical modelling, environmental quality assessment, Nigeria, spatial analysis, econometrics, stochastic processes*

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