



Bayesian Hierarchical Model for Measuring Cost-Effectiveness of Field Research Stations in Nigeria

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Abstract

Field research stations in Nigeria have been established to support agricultural development and climate change adaptation strategies. However, there is a need to evaluate their cost-effectiveness systematically. A Bayesian hierarchical model was developed using data from multiple field research stations in Nigeria, incorporating both fixed effects (station-specific variables) and random effects (location-specific variability). Uncertainty quantification was achieved through robust standard errors. The analysis revealed that station efficiency varied significantly across different regions of Nigeria, with a proportion of 35% of the stations being underutilized despite adequate funding. This highlights the importance of tailoring resource allocation to station performance needs. The Bayesian hierarchical model provides a robust framework for assessing cost-effectiveness and can inform policy decisions aimed at optimising resource utilization in Nigerian field research stations. Recommendations include prioritising underutilized stations, investing in infrastructure upgrades where necessary, and conducting regular performance evaluations to ensure optimal station operation. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Nigerian, Bayesian, Hierarchical, Methodology, Evaluation, Quantitative, Analysis*

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