African Sustainable Urban Development

Bayesian Hierarchical Model for Evaluating Clinical Outcomes in Smallholder Farming Systems of Ghana: Methodological Insights

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Abstract

Bayesian hierarchical models are increasingly used in agricultural research to analyse complex data structures such as those found in smallholder farming systems. In Ghana, clinical outcomes of interventions targeting these systems have been examined through various statistical methods. The research employs a Bayesian hierarchical model to analyse data from multiple smallholder farms, accounting for variability at different levels (e.g., farm-level interventions and broader environmental factors). A key finding is that the variance in clinical outcomes significantly decreases when considering nested structures within the model. The results suggest a more nuanced understanding of how interventions impact farm-level health metrics compared to traditional modelling approaches. Future research should explore the robustness of this method across different types of agricultural settings and intervention programmes. Bayesian Hierarchical Model, Smallholder Farming Systems, Clinical Outcomes, Ghana Model estimation used $\hat{\{\theta\}} = argmin\{\theta\} sumiell(yi, f\theta(\xi)) + \lambda lVert\theta rVert 2^2$, with performance evaluated using out-of-sample error.

Keywords: *African geography, Bayesian inference, hierarchical modelling, clinical trials, data analysis, econometrics, stochastic processes*

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