Bayesian Hierarchical Model for Measuring Adoption Rates in Smallholder Farms Systems in Tanzania: A Methodological Evaluation

Simba Chuma[1]**, Kamanda Mushi**[2]

[1] State University of Zanzibar (SUZA)

[2] Department of Data Science, State University of Zanzibar (SUZA)

Author notes

Simba Chuma is affiliated with State University of Zanzibar (SUZA) and focuses on Computer Science research in Africa. Kamanda Mushi is affiliated with Department of Data Science, State University of Zanzibar (SUZA) and focuses on Computer Science research in Africa.

Abstract

Smallholder farming systems in Tanzania face challenges related to technology adoption, necessitating robust methodological approaches. A Bayesian hierarchical model was employed to analyse data collected from to on adoption rates of sustainable farming technologies. The model accounts for spatial and temporal variations, using a Gaussian process prior for the random effects. The analysis revealed significant variation in technology adoption across different regions, with some areas showing adoption rates up to 40% higher than others. The Bayesian hierarchical model effectively captured heterogeneity in adoption patterns and provided nuanced insights into factors influencing technology uptake. Future studies should consider expanding the geographical scope and incorporating additional socio-economic variables to enhance model accuracy. Bayesian Hierarchical Model, Smallholder Farms, Adoption Rates, Sustainable Technologies, Tanzania 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: *Geographic, Hierarchical Models, Bayesian Statistics, Methodology, Adoption Rates, Smallholder Farms, Tanzania*

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