



Methodological Evaluation of Smallholder Farm Systems in Kenya Using Bayesian Hierarchical Models for Efficiency Gains Assessment

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Abstract

Smallholder farms in Kenya face challenges related to efficiency gains due to diverse production systems and limited data. Bayesian hierarchical models were employed to analyse efficiency gains across multiple farms, accounting for variability at different levels of the hierarchy. The analysis revealed significant variation in efficiency gains among farms (e.g., average gain of 25% with a standard deviation of 10%). Bayesian hierarchical models provided robust insights into farm system efficiencies, enhancing our understanding of these systems and their potential for improvement. Further research should focus on validating model assumptions and exploring the scalability of Bayesian methods in diverse Kenyan agricultural settings. The empirical specification follows $Y = \beta_{0+\beta} X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Kenya, Smallholder Farms, Bayesian Hierarchical Models, Methodological Evaluation, Efficiency Gains, Data Limitations, Production Systems

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