Reliability Measurement in Tanzanian Smallholder Farming Systems Using Bayesian Hierarchical Models

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Abstract

Smallholder farming systems in Tanzania are characterized by variability and uncertainty due to climatic conditions, soil fertility, and market fluctuations. A Bayesian hierarchical model was developed to account for heterogeneity among farms, incorporating data on crop yields, rainfall patterns, soil quality, and farmer practices from a sample of 100 smallholder farms across Tanzania. The analysis revealed significant variability in system reliability across different regions and farming contexts, with some areas showing yield stability by up to 95% confidence intervals under drought conditions. This study provides evidence for the effectiveness of Bayesian hierarchical models in measuring reliability within smallholder farming systems in Tanzania. The findings suggest that targeted interventions focusing on soil management and climate-resilient crop varieties could enhance system performance, thereby improving food security in these areas. The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

ABSTRACT-ONLY PUBLICATION

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