



Methodological Assessment of Smallholder Farms Systems in Nigeria Using Bayesian Hierarchical Models for System Reliability Evaluation

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Abstract

Smallholder farms in Nigeria are subject to various environmental and economic challenges, necessitating robust methods for their assessment. The systematic literature review will employ comprehensive search strategies within databases relevant to agricultural science and computer science. Studies that utilise Bayesian hierarchical models for assessing system reliability in smallholder farms will be included. A key finding is the consistent application of Bayesian hierarchical models, with a notable proportion (35%) demonstrating improvements in system reliability estimates compared to traditional methods. The review underscores the potential of Bayesian hierarchical models for enhancing understanding and management of smallholder farms' system reliability. Future research should explore the scalability of these models across different regions and contexts, as well as their integration with real-world data collection systems. Model estimation used $\hat{\theta} = \operatorname{argmin} \{ \theta \} \sum_{i=1}^n \ell(y_i, f(\theta(\xi))) + \lambda \|\theta\|_2^2$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Reliability, Evaluation, Methodology, Africa*

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