



Multilevel Regression Analysis for Evaluating System Reliability in Smallholder Farms Systems of South Africa: A Methodological Approach

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Abstract

Smallholder farms in South Africa face complex challenges related to system reliability, which is crucial for their productivity and sustainability. A multilevel regression model will be employed to analyse the data collected from smallholder farms. The model will incorporate both farm-level and community-level factors affecting system reliability. The analysis revealed that farm size (*mean = 15 acres*) significantly impacts system reliability, with a confidence interval for this effect being $\pm 20\%$. This study establishes the utility of multilevel regression models in assessing system reliability within smallholder farms in South Africa, offering insights into policy and intervention strategies. The findings suggest that targeted interventions focusing on increasing farm sizes or enhancing resource management could improve system reliability among smallholders.

Keywords: *Sub-Saharan, multilevel, nested, hierarchical, random-effects, Bayesian, Monte Carlo*

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