Field Trial Replication for Measuring Risk Reduction in Smallholder Farms Systems: A Randomized Approach in South Africa

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Abstract

This study addresses a current research gap in Computer Science concerning Methodological evaluation of smallholder farms systems in South Africa: randomized field trial for measuring risk reduction in South Africa. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured analytical approach was used, integrating formal modelling with domain evidence. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of smallholder farms systems in South Africa: randomized field trial for measuring risk reduction, South Africa, Africa, Computer Science, replication study This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, randomized controlled trial, agronomy, precision agriculture, yield gap, resilience assessment, agroecology*

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