Methodological Evaluation of Off-Grid Communities Systems in South Africa: A Multilevel Regression Analysis on Yield Improvements,

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Abstract

This scoping review explores methodological approaches to evaluating off-grid communities systems in South Africa with a focus on yield improvements. A systematic review approach was employed, including literature searches through databases such as PubMed and Google Scholar. Studies were screened based on predefined inclusion criteria focusing on methodologies used in South African off-grid communities for enhancing crop yields. The analysis revealed that multilevel regression models incorporating community-level interventions and individual farmer practices showed significant yield improvements ranging from 10% to 25%, but the variability across regions necessitates further investigation. This study concludes that a comprehensive methodological approach is essential for understanding the multifaceted effects of off-grid systems on agricultural productivity in South Africa, with specific findings suggesting substantial potential for yield enhancement through targeted interventions at both community and individual levels. Future research should prioritise replication studies to validate findings across different geographical contexts and incorporate longitudinal data to track long-term impacts. The empirical specification follows $Y = \vec{\beta_{0+\beta}} \, p \, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, Geographic Information Systems (GIS), Methodological frameworks, Regression analysis, Spatial data analytics, Sustainability metrics, Village development initiatives*

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