



Methodological Evaluation of Off-Grid Communities Systems in South Africa Using Difference-in-Differences Models

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Abstract

Off-grid communities in South Africa are increasingly adopting solar-powered irrigation systems to enhance agricultural productivity. However, variability and underreporting of yield improvements hinder their effectiveness. A systematic literature review was conducted, involving the identification and analysis of peer-reviewed articles published between and . Studies were selected based on their use of DiD models to assess yield changes post-intervention (system installation). The analysis revealed a moderate proportion (approximately 40%) of studies achieving statistically significant positive yields improvements, with some showing substantial variations in the magnitude and direction of effects across different regions. DiD models provided robust evidence for yield improvement but highlighted inconsistencies due to varying baseline conditions and intervention specifics. Future research should consider using DiD alongside other econometric methods to address these inconsistencies, ensuring more reliable and generalizable findings. The empirical specification follows $Y = \beta_{0+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Agricultural Productivity, Solar-Powered, Irrigation, Yield, Growth, Econometrics*

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