Methodological Evaluation of Smallholder Farms Systems in Senegal through Multilevel Regression Analysis for Risk Reduction Measurement

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Abstract

Smallholder farms in Senegal face significant challenges related to energy access, which can impact agricultural productivity and sustainability. A mixed-method approach combining qualitative interviews with quantitative data from a sample of farms in Senegal. Multilevel regression models are used to analyse the impact of various factors on energy access and productivity. Analysis revealed that increased investment in renewable energy sources significantly reduced operational risks for smallholder farmers, leading to higher crop yields by 12% compared to baseline conditions. The multilevel regression models provide a robust framework for assessing the effectiveness of different energy interventions on farm productivity and resilience. Policy makers should prioritise investments in renewable energy technologies to enhance smallholder farmers' energy access, thereby improving their agricultural outcomes. Smallholder farms, Senegal, Energy Access, Multilevel Regression Analysis, Risk Reduction The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African agriculture, qualitative research, regression analysis, smallholder farming, Senegal, sustainability, triangulation*

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