



Reliability Assessment of Smallholder Farm Systems in Rwanda Using Quasi-Experimental Design: A Comparative Study

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Abstract

Smallholder farming systems in Rwanda are crucial for food security and rural livelihoods but face significant challenges due to climate variability. A mixed-method approach combining field observations with econometric models was employed to evaluate system performance under varying climatic conditions. The analysis revealed that by optimising energy use through the implementation of solar-powered irrigation systems, farm productivity increased by an average of 15% in drought-prone areas. This study underscores the importance of integrating renewable energy solutions into smallholder farming practices to enhance resilience and sustainability. Policy makers should invest in research and development for scalable renewable energy technologies tailored to Rwandan smallholders. Rwanda, Smallholder Farms, Quasi-Experimental Design, Renewable Energy, Farm Reliability The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: Rwanda, Smallholder Agriculture, Quasi-Experimental Design, Methodology, Evaluation, Sustainability, Climate Adaptation

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