African Urban Geography (Geography/Social/Planning)

Methodological Evaluation of Off-Grid Communities Systems in Tanzania: Quasi-Experimental Design for Efficiency Gains

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Abstract

Off-grid communities in Tanzania rely on various energy systems for lighting, cooking, and other essential services. There is a need to evaluate these systems' efficiency to inform policy and improve community welfare. A mixed-methods approach combining quantitative data analysis with qualitative interviews was employed. The study utilised a difference-in-differences (DiD) model to compare pre- and post-intervention performance of off-grid energy systems. The DiD model showed an average efficiency gain of 25% in the intervention group compared to controls, indicating significant improvements in system reliability and cost-effectiveness. This quasi-experimental design provided robust evidence for assessing the effectiveness of off-grid community energy systems, contributing to better policy decisions and resource allocation. Policy makers should prioritise investments in off-grid energy systems that demonstrate efficiency gains through rigorous evaluation methods. Off-Grid Communities, Quasi-Experimental Design, Efficiency Gains, Difference-in-Differences (DiD), Energy Systems The empirical specification follows $Y = \beta_{0+\beta}^{\rightarrow} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Tanzania, Geographic Information Systems, Quasi-Experimental Design, Energy Access, Renewable Technologies, Data Analytics, Sustainability Metrics*

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