



Methodological Evaluation of Power-Distribution Equipment Systems in Tanzania: Randomized Field Trial for Risk Reduction Assessment

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Abstract

Power distribution equipment (PDE) systems are critical for reliable power supply in rural Tanzania. However, their effectiveness and reliability vary significantly across different regions. A randomized field trial was conducted in four rural districts. Randomized block design was used with stratified randomization by district type (urban vs. rural) and population density (high vs. low). Data collection included pre- and post-trial surveys, equipment performance metrics, and community feedback. In the high-density urban areas, there was a statistically significant improvement in power supply reliability with an $R^2 = 0.65$ ($p < 0.01$) indicating that up to 65% of the variance in power supply stability can be attributed to PDE system upgrades. The randomized field trial demonstrated the effectiveness of PDE system improvements in enhancing power supply reliability, particularly in high-density urban areas where infrastructure resilience was significantly bolstered. Based on findings, immediate investment and maintenance strategies should focus on upgrading PDE systems in high-density urban districts to ensure consistent power supply for communities. Power distribution equipment, randomized field trial, risk reduction, reliability, R^2

Keywords: Tanzania, Power-Distribution Equipment, Randomized Field Trial, Methodology, Risk Assessment, Geographic Information Systems, Energy Poverty

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