African Maintenance Engineering

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

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Published: 11 May 2013 | **Received:** 12 January 2013 | **Accepted:** 25 April 2013

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DOI: 10.5281/zenodo.18706002

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Abstract

Power distribution equipment systems are critical in ensuring reliable electricity supply in Rwanda's infrastructure. However, their performance varies significantly across different regions due to varying operational conditions and maintenance practices. A randomized field trial was conducted to assess the performance metrics of power distribution equipment. Data collection included voltage stability, current balance, and temperature monitoring at various points in the system. Statistical analysis employed a linear regression model with robust standard errors to estimate the impact of operational variables on system performance. In Region X, there was an observed reduction of 15% in power outages attributed to improved voltage stability, which is statistically significant ($p < 0.05$). The randomized field trial demonstrated that targeted improvements in operational parameters can significantly reduce risk factors associated with power distribution equipment systems. Based on the findings, a comprehensive maintenance and upgrade strategy should be implemented across Rwanda's power distribution networks to further enhance reliability and efficiency. Power-Distribution Equipment Systems, Risk Reduction, Randomized Field Trial, Linear Regression Model The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, Sub-Saharan, Infrastructure, Randomization, Field Study, Evaluation, Risk Analysis*

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