African Textile Engineering

Methodological Assessment of Power-Distribution Equipment Systems in Nigeria: A Randomized Field Trial on Reliability Evaluation

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Abstract

Power distribution systems in Nigeria face significant challenges due to infrastructure deficiencies and frequent power outages. A randomized field trial was conducted in urban areas of Nigeria, where 120 randomly selected substations were monitored over six months. Equipment failures were recorded using sensors that tracked voltage fluctuations, power surges, and temperature anomalies within the distribution network. The analysis revealed a failure rate of 5% for equipment due to overheating, with an average duration of failure lasting approximately 3 hours per incident. This study provides evidence-based insights into the reliability of power-distribution systems in Nigeria and highlights the importance of preventive maintenance strategies. Implementing a predictive maintenance programme targeting overheated equipment could reduce system failures by up to 15% within one year, based on preliminary results. Power Distribution Systems, Reliability Evaluation, Randomized Field Trial, Substations The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, African, Randomized, Field, Evaluation, Systems, Reliability, Techniques*

ABSTRACT-ONLY PUBLICATION

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