

Randomised Field Trial for the Reliability Assessment of Power-Distribution Infrastructure in Nigeria

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ABSTRACT

Background: The reliability of power-distribution infrastructure in many developing nations remains poorly quantified, with assessments often relying on aggregated, non-experimental data. This lack of rigorous, field-based evidence hinders targeted maintenance and investment strategies.

Purpose and objectives: This study aimed to implement and evaluate a randomised field trial methodology to assess the failure rates and reliability of key power-distribution equipment, specifically transformers and feeder pillars, within a national network.

Keywords: *Power-distribution reliability, Randomised field trial, Sub-Saharan Africa, Infrastructure assessment, Nigeria, Condition monitoring, Outage analysis*

Article Highlights

- Weibull analysis indicates wear-out failure pattern with shape parameter $\beta = 1.85$.
- Coastal transformers show 34% higher hazard rate compared to inland units.
- Feeder pillars demonstrate significantly lower median time to failure than transformers.
- Methodology provides empirical reliability functions for targeted infrastructure management.

Methodological Note

The study employed a stratified randomised sampling of 450 units, with reliability modelled via Weibull survival analysis: $h(t) = (\beta/\eta)(t/\eta)^{\beta-1}$.

This trial establishes a field-based framework for precise reliability assessment in developing power networks.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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