

A Randomised Field Trial Methodology for Evaluating Power-Distribution System Reliability in Tanzania

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ABSTRACT

Background: Power-distribution reliability in sub-Saharan Africa is critically understudied, with existing assessments often relying on aggregated utility data or theoretical models that fail to capture localised, real-world performance of equipment under diverse operational conditions.

Purpose and objectives: This article presents a novel field-trial methodology designed to empirically evaluate the reliability of medium-voltage distribution equipment, specifically pole-mounted transformers and switchgear, within a national grid.

Keywords: *Randomised controlled trial, Power-distribution reliability, Sub-Saharan Africa, Infrastructure evaluation, Field experiment, System reliability assessment*

Article Highlights

- Presents a stratified, cluster-randomised field trial design for medium-voltage equipment.
- Methodology validated through simulation to detect 15 percentage point reliability improvements.
- Employs Weibull proportional hazards model with robust, clustered statistical inference.
- Framework enables high-fidelity reliability data generation for major equipment rollouts.

Methodological Innovation

First formalised methodology for implementing randomised controlled trials in power-distribution system reliability assessment within sub-Saharan African contexts.

This is a methodology article presenting a novel field-trial framework without empirical results from a completed study.

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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