

Replication and Methodological Evaluation of Power-Distribution System Reliability in Tanzania

A Panel-Data Estimation Study (2000–2026)

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ABSTRACT

Background: Reliable power distribution is critical for economic development, yet many sub-Saharan nations face persistent challenges. Previous studies on system reliability in the region have often relied on cross-sectional data, which fails to account for unobserved heterogeneity across utility networks and temporal dynamics.

Purpose and objectives: This study aims to replicate and methodologically evaluate a prior analysis of distribution-system reliability. The core objective is to assess the robustness of panel-data estimation techniques for modelling the relationship between equipment investment, maintenance practices, and sustained outage frequency.

Keywords: *Power-distribution reliability, Panel-data estimation, Sub-Saharan Africa, Methodological evaluation, Electrical grid infrastructure, System reliability metrics*

Article Highlights

- Replication confirms targeted transformer upgrades reduce outage frequency.
- Effect size diminishes significantly with stricter panel model specifications.
- Panel-data methods are essential but model specification critically influences results.
- Original conclusions on investment efficacy require qualification regarding scale.

Core Methodological Insight

The study demonstrates how unmodelled heterogeneity in prior analyses can lead to overestimation of infrastructure investment effects on reliability metrics.

This replication underscores the importance of robust panel specifications for infrastructure policy.

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