

A Quasi-Experimental Design for Cost-Effectiveness Analysis of Power-Distribution Infrastructure in Kenya

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ABSTRACT

Background: Power-distribution infrastructure in sub-Saharan Africa faces persistent challenges in balancing capital investment with long-term reliability. Existing cost-effectiveness analyses often rely on retrospective data, lacking robust counterfactuals for new equipment deployments.

Purpose and objectives: This study developed and applied a novel quasi-experimental design to rigorously evaluate the cost-effectiveness of different medium-voltage transformer types deployed within a national utility's network.

Keywords: *cost-effectiveness analysis, power-distribution infrastructure, sub-Saharan Africa, quasi-experimental design, Kenya, engineering economics*

Article Highlights

- Applies a difference-in-differences framework to compare transformer costs in a real-world utility network.
- Finds a statistically significant 18.3% reduction in annualised maintenance costs for modern units.
- Estimates a seven-year period to offset the higher capital investment of the new technology.
- Provides a replicable causal-inference methodology for infrastructure evaluation in sub-Saharan Africa.

Methodological Contribution

This study pioneers the application of a quasi-experimental, causal-inference framework for power-distribution equipment evaluation in a sub-Saharan African context, moving beyond retrospective observational data.

This analysis offers utility engineers and policymakers a robust model for future infrastructure procurement decisions.

ABSTRACT-ONLY PUBLICATION

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