

Quasi-Experimental Evaluation of Efficiency Gains in Tanzanian Power-Distribution Networks

A Methodological Assessment

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ABSTRACT

Background: Power-distribution networks in sub-Saharan Africa face persistent efficiency challenges, including high technical losses and unreliable supply. While infrastructure upgrades are ongoing, robust empirical evidence quantifying the impact of specific equipment interventions remains scarce, hindering optimal investment and policy decisions.

Purpose and objectives: This study aims to develop and apply a rigorous quasi-experimental framework to evaluate the causal effect of modernising distribution equipment—specifically, the installation of amorphous core transformers and automated reclosers—on network efficiency within a real-world operational context.

Keywords: *Power-distribution networks, Technical losses, Quasi-experimental design, Sub-Saharan Africa, Efficiency evaluation, Infrastructure upgrades, Network reliability*

Article Highlights

- A 4.7 percentage point reduction in technical losses was causally attributed to equipment upgrades.
- Sustained interruptions fell by 31% in the treatment group, with strongest effects on rural feeders.
- The study provides a replicable quasi-experimental template for evidence-based asset management.
- Findings support strategic deployment of high-efficiency transformers and automated reclosers.

Core Methodology

A difference-in-differences design compared 42 treatment substations with 38 matched controls to isolate the causal effect of modern distribution equipment on network efficiency metrics.

This study offers a rigorous framework for evaluating infrastructure investments in constrained utility environments.

ABSTRACT-ONLY PUBLICATION

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