

Methodological Evaluation and Cost-Effectiveness of Power-Distribution Equipment Systems in Senegal

A Difference-in-Differences Modelling Approach

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ABSTRACT

Background: The reliability and economic efficiency of power-distribution networks are critical for sustainable development in West Africa. In Senegal, ageing infrastructure and investment constraints necessitate rigorous evaluation of equipment upgrades, yet robust methodological frameworks for such appraisals are lacking in the regional literature.

Purpose and objectives: This study aims to develop and apply a quasi-experimental econometric model to quantify the cost-effectiveness of recent power-distribution equipment interventions. The primary objective is to determine the causal impact of these upgrades on system performance and maintenance expenditure.

Keywords: *Power-distribution networks, cost-effectiveness analysis, difference-in-differences modelling, West Africa, infrastructure investment, reliability engineering, developing economies*

Article Highlights

- DiD modelling provides a credible framework for causal inference in infrastructure evaluation.
- Equipment modernisation yielded an 18.7% reduction in annual maintenance costs.
- Methodology addresses the lack of robust evaluation frameworks in regional literature.
- Findings support prioritising investments with quantitatively verified returns.

Methodological Contribution

Applies quasi-experimental econometric modelling to power-distribution evaluation in West Africa, filling a gap in regional infrastructure assessment literature.

This study offers utilities and policymakers an evidence-based framework for investment decisions.

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