

A Bayesian Hierarchical Model for Adoption Rates in South Africa's Power-Distribution Equipment Systems

A Policy Analysis, 2000–2026

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ABSTRACT

Background: The modernisation of power-distribution equipment systems is critical for infrastructure resilience. In South Africa, understanding the pace and drivers of technological adoption across diverse municipalities and utilities has been hampered by fragmented data and heterogeneous regional implementation capacities.

Purpose and objectives: This policy analysis develops and applies a novel Bayesian hierarchical model to estimate and project adoption rates for critical distribution equipment, providing a robust evidence base for national infrastructure investment and regulatory strategy.

Keywords: *Bayesian hierarchical modelling, technology adoption, power-distribution systems, sub-Saharan Africa, infrastructure policy, energy transition, grid modernisation*

Article Highlights

- Bayesian model reveals substantial regional heterogeneity in adoption rates
- Automated feeder switch adoption shows significant link to fiscal incentives
- Projections indicate persistent low adoption in lowest-performing regions
- Analysis demonstrates insufficiency of one-size-fits-all national policy

Methodological Note

Bayesian hierarchical modelling with region-specific parameters enables quantification of latent implementation capacities using fragmented data sources.

This analysis provides evidence for differentiated regional policy approaches.

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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