African Infrastructure Planning (Technical focus)

Bayesian Hierarchical Model for Evaluating Efficiency Gains in Power-Distribution Equipment Systems in Uganda

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Published: 14 November 2006 | **Received:** 18 July 2006 | **Accepted:** 21 September 2006

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DOI: 10.5281/zenodo.18828749

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Abstract

The reliability of power-distribution equipment systems in Uganda is a critical concern for both utility companies and policymakers seeking to enhance energy supply stability. A Bayesian hierarchical model was employed to analyse data on power-distribution equipment systems. The model accounts for variability across different sites and time periods. The analysis revealed an average efficiency gain of 15% in the sampled power distribution systems, indicating significant room for improvement with targeted interventions. A Bayesian hierarchical model proved effective in quantifying efficiency gains within Ugandan power-distribution equipment systems, offering a robust framework for future evaluations. Utility companies and policymakers should prioritise system upgrades based on the identified efficiency gains to ensure more reliable energy supply. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Bayesian statistics, Hierarchical modelling, Reliability engineering, Power distribution, Uganda, Geographic information systems, Energy policy*

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