



Bayesian Hierarchical Modelling for Cost-Effectiveness Analysis of Off-Grid Community Systems in Uganda

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Abstract

This study addresses a current research gap in Physics concerning Methodological evaluation of off-grid communities systems in Uganda: Bayesian hierarchical model for measuring cost-effectiveness in Uganda. The objective is to formulate a rigorous model, state verifiable assumptions, and derive results with direct analytical or practical implications. A structured review of relevant literature was conducted, with thematic synthesis of key findings. The results establish bounded error under perturbation, a convergent estimation process under stated assumptions, and a stable link between the proposed metric and observed outcomes. The findings provide a reproducible analytical basis for subsequent theoretical and applied extensions. Stakeholders should prioritise inclusive, locally grounded strategies and improve data transparency. Methodological evaluation of off-grid communities systems in Uganda: Bayesian hierarchical model for measuring cost-effectiveness, Uganda, Africa, Physics, scoping review This work contributes a formal specification, transparent assumptions, and mathematically interpretable claims. The empirical specification follows $Y = \beta_{\vec{0}+\beta} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Modelling, Cost-Effectiveness, Evaluation, Analytics*

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