Bayesian Hierarchical Model for Evaluating Cost-Effectiveness of Power-Distribution Equipment in Senegal

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Abstract

The provision of reliable power distribution equipment in Senegal is crucial for economic development but often expensive. Current cost-effectiveness evaluations lack a rigorous statistical framework. A Bayesian hierarchical model was constructed to account for variability across regions. The model incorporates uncertainty through robust standard errors and confidence intervals. The analysis revealed significant disparities in cost-effectiveness among different power-distribution equipment models, particularly in rural areas where the cost per unit of electricity produced varied by up to 30%. This study provides a novel method for evaluating regional variations in cost-effectiveness that can guide policy decisions in Senegal's power sector. Policy makers should consider regional-specific models when determining investment priorities in power distribution equipment. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Model, Evaluation, Cost-Effectiveness, Infrastructure*

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