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Bayesian Hierarchical Model for Measuring Adoption Rates in Off-Grid Community Systems in Uganda: A Methodological Evaluation

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Abstract

Off-grid community systems in Uganda are increasingly used for water purification and waste management. However, understanding their adoption rates is challenging due to variability across communities. A Bayesian hierarchical model was developed using data from multiple community sites, accounting for spatial and temporal variations. Model parameters were estimated with uncertainty quantified through credible intervals. The model demonstrated an overall adoption rate of 65% across the study areas, with significant variability between different communities (ranging from 40% to 80%). The Bayesian hierarchical model provided a robust method for estimating and quantifying adoption rates in off-grid community systems. Further studies should validate these findings using additional data sets and explore factors influencing system adoption. Bayesian Hierarchical Model, Off-Grid Systems, Adoption Rates, Uganda The empirical specification follows $Y = \vec{\beta_{0+\beta}} \, p \, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *African, Bayesian, Hierarchical, Methodology, Quantitative, Sustainability, Uganda*

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