Bayesian Hierarchical Model for Measuring Adoption Rates in Municipal Infrastructure Asset Systems in Senegal: A Methodological Evaluation

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Abstract

This study focuses on municipal infrastructure asset systems in Senegal, where accurate measurement of adoption rates is crucial for policy-making and resource allocation. A Bayesian hierarchical model will be employed, incorporating prior knowledge and data from various municipalities in Senegal. Uncertainty quantification will be achieved through robust standard errors. The analysis revealed that adoption rates for water supply systems were notably higher than those for waste management infrastructure (direction: significantly more adoption rate for water supply). This study validates the Bayesian hierarchical model's efficacy in measuring adoption rates, providing a robust framework for future research and policy implementation. Future studies should consider expanding the scope of the analysis to include additional asset categories and incorporate feedback from stakeholders. 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, Markov Chain Monte Carlo, Random Effects, Spatial Statistics, Adoption Analysis*

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