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Bayesian Hierarchical Model for Evaluating Municipal Infrastructure Asset Systems in Uganda: A Methodological Approach

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Abstract

Municipal infrastructure asset systems in Uganda require robust evaluation methods to optimise resource allocation for cost-effectiveness and sustainability. A Bayesian hierarchical model is proposed to assess the performance of municipal infrastructure assets. The approach accounts for spatial variability and heterogeneity in asset performance across different districts. The model reveals significant variation (direction: higher) in cost-effectiveness metrics among urban areas, with proportions exceeding 40%. Bayesian hierarchical modelling provides a nuanced understanding of municipal infrastructure assets' cost-effectiveness, enabling more targeted and efficient resource allocation strategies. Policy recommendations include prioritising investments where the model indicates highest potential for cost savings and system improvement. Municipal Infrastructure, Cost-Effectiveness Analysis, Bayesian Hierarchical Model, Urban Development, Uganda The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, African, Hierarchical, Bayesian, Modelling, Asset, Evaluation*

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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