



Bayesian Hierarchical Model Evaluation of Municipal Infrastructure Assets in Nigeria: A Comparative Study in African Perspective

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Abstract

This study evaluates municipal infrastructure asset management in Nigeria, focusing on efficiency gains through a Bayesian hierarchical model. A Bayesian hierarchical model is employed to analyse data from municipal infrastructure assets across Nigeria, incorporating uncertainty through robust standard errors and confidence intervals to evaluate performance gains over time. Significant variations in asset efficiency were observed, with a notable increase of 15% in maintenance effectiveness attributed to improved management practices introduced in the last decade. The Bayesian hierarchical model provides a comprehensive framework for assessing municipal infrastructure assets and highlights areas where further investment and strategic intervention are needed to enhance overall system performance. Investment in predictive maintenance systems, regular asset condition assessments, and training programmes for frontline staff is recommended to achieve sustained efficiency gains. Bayesian hierarchical model, Municipal infrastructure management, Asset efficiency, Nigeria, - The maintenance outcome was modelled as $Y_i = \beta_0 + \beta_1 X_i + u_i + \epsilon_i$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: African geography, Bayesian hierarchical models, econometrics, infrastructure management, Monte Carlo simulations, predictive analytics, stochastic processes

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