



Bayesian Hierarchical Model Replication Study on Municipal Infrastructure Asset Systems in Nigeria

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Abstract

Recent studies have highlighted the challenges in assessing the reliability of municipal infrastructure systems in Nigeria. These challenges include inadequate data and methodological discrepancies. The study replicates previous work by reanalyzing existing data using the same Bayesian hierarchical model. Key aspects include specifying prior distributions and estimating posterior distributions through Markov Chain Monte Carlo methods. The analysis revealed that incorporating spatial dependencies significantly improved the accuracy of reliability estimates, with a notable improvement in system performance metrics across different regions. This replication study supports the utility of Bayesian hierarchical models for assessing municipal infrastructure systems in Nigeria, particularly when considering geographical variations. Future research should explore extensions to this model, such as incorporating additional environmental factors or improving data collection methods. Bayesian Hierarchical Model, Municipal Infrastructure, Reliability Assessment, 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: Nigeria, Bayesian Hierarchical Model, Asset Management, Reliability Engineering, Monte Carlo Simulation, Spatial Statistics, Methodological Evaluation

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