



Bayesian Hierarchical Model Replication for Measuring System Reliability in Municipal Infrastructure Assets Systems in Ethiopia, 2010 Context

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Abstract

This study builds upon previous research by applying a Bayesian hierarchical model to assess system reliability in municipal infrastructure assets systems within Ethiopia's municipal context. A Bayesian hierarchical model was employed to analyse data from municipal infrastructure systems across Ethiopia. The model accounts for variability at different levels of aggregation (e.g., city, district) by incorporating prior information and uncertainty. The results indicate that the reliability estimates vary significantly between cities, with a proportion of 75% of assets rated as high-reliability in urban areas compared to 60% in rural settings. This highlights the need for targeted investment strategies based on city-level data. The Bayesian hierarchical model provides a nuanced understanding of system reliability across different municipal contexts, with significant variation observed between urban and rural environments. Policy recommendations include prioritising investments in infrastructure systems within cities to ensure high-reliability standards, informed by the findings from this replication study. The maintenance outcome was modelled as $Y \{ \} = \text{beta } 0 + \text{beta } 1 X \{ \} + ui + \text{varepsilon} \{ \}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Bayesian Hierarchical Model, Monte Carlo Simulation, Markov Chain Monte Carlo, Reliability Analysis, Spatial Statistics, Quantile Regression*

ABSTRACT-ONLY PUBLICATION

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