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Bayesian Hierarchical Model Assessment of Transport Maintenance Depot Systems in Senegal

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Abstract

This study focuses on evaluating transport maintenance depot systems in Senegal, a developing country where infrastructure management is crucial for operational efficiency. Bayesian Hierarchical Models (BHMs) were employed to analyse the operational parameters of Senegalese transport maintenance depots, incorporating both fixed effects and random effects to account for variability across different depots. The models' effectiveness was evaluated using cross-validation techniques to ensure robustness and reliability. A key finding is that the hierarchical structure of BHMs allowed for a more nuanced understanding of depot performance, revealing significant disparities in efficiency among depots even when controlled for fixed factors such as depot size and location. Specifically, one depot showed an improvement potential of up to 25% in maintenance turnaround times with optimal resource allocation. The Bayesian hierarchical models provided valuable insights into the operational inefficiencies of Senegalese transport maintenance depots, highlighting areas where improvements can be made to enhance overall system performance and reduce costs. Based on the findings, it is recommended that Senegal's transportation authorities implement targeted resource allocation strategies for identified underperforming depots. Additionally, continuous monitoring and periodic recalibration of BHMs should be considered to adapt to changing operational conditions. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, Bayesian, Hierarchical, Markov Chain Monte Carlo, Efficiency, Depots, Optimization*

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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