



Bayesian Hierarchical Model Assessment of Maintenance Depot Efficiency in Ghanaian Transport Systems,

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Abstract

This study aims to evaluate the efficiency of transport maintenance depots in Ghanaian transportation systems, utilising a Bayesian hierarchical model. A Bayesian hierarchical model was employed to analyse data from maintenance depots across Ghana, incorporating spatial and temporal variability. This approach allows for the estimation of depot-specific efficiencies while accounting for inter-depot correlations. The analysis revealed significant differences in efficiency among depots, with some showing substantial gains (up to 30%) when compared to industry benchmarks. This study provides robust evidence supporting the use of Bayesian hierarchical models for evaluating depot performance and highlights the potential for these methodologies in improving maintenance operations across Ghana's transportation sector. Based on findings, a comprehensive review of depot operational strategies should be conducted, focusing on those with high efficiency gains to replicate best practices. Additionally, further research is recommended to test model robustness under varying conditions. The maintenance outcome was modelled as $Y = \beta_0 + \beta_1 X + u_i + \text{varepsilon}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, Hierarchical, Bayesian, Modelling, Efficiency, Depots, Ghana*

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