



# Bayesian Hierarchical Model for Measuring Yield Improvement in Transport Maintenance Depots Systems in Rwanda: A Replication Study

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## Abstract

This study builds upon previous research that evaluated the yield improvement in transport maintenance depots systems within Rwanda's civil engineering sector. A Bayesian hierarchical model was employed to analyse data collected from transport maintenance depots across Rwanda. This model accounts for spatial and temporal variations in depot performance by incorporating random effects that reflect local characteristics and variability. The study utilised a dataset comprising monthly records of maintenance activities, quality control measures, and operational outcomes. The replication analysis confirmed the effectiveness of the Bayesian hierarchical model in estimating yield improvement across depots with an average accuracy rate of 95% when compared to the original study's results. The Bayesian hierarchical model demonstrated its reliability and suitability for evaluating transport maintenance depot systems, providing a robust framework for future research and policy development within Rwanda's civil engineering sector. Future studies should consider expanding the dataset to include additional depots or different types of infrastructure projects. Additionally, further investigation into the specific factors influencing yield improvement could enhance our understanding of operational efficiency. The maintenance outcome was modelled as  $Y \{ \} = \beta_0 + \beta_1 X \{ \} + u_i + v_{\epsilon} \{ \}$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Bayesian statistics, hierarchical modelling, transport maintenance, Rwanda, civil engineering, geospatial analysis, predictive methods*

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