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Bayesian Hierarchical Model for Measuring Adoption Rates in Transport Maintenance Depots: An Evaluation Methodology in Rwanda

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Abstract

Transport maintenance depots play a critical role in ensuring the efficient operation of the transport sector in Rwanda. Despite their importance, there is limited understanding of how these depots are adopted and utilised. The methodology involves utilising a Bayesian hierarchical model, which allows for the estimation of adoption rates across multiple depots while accounting for heterogeneity among them. Data from ten randomly selected depots were collected and analysed. A significant proportion (75%) of the depots in Rwanda have adopted the maintenance practices recommended by industry standards, with substantial variation observed between depots. The Bayesian hierarchical model provided a nuanced understanding of adoption patterns across different depots, facilitating more targeted interventions to improve efficiency and compliance. Based on the findings, it is recommended that resources be allocated to support depots with lower adoption rates in adopting best practices. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Bayesian statistics, hierarchical modelling, transport systems, maintenance depots, adoption rates, geographic information systems, spatial analysis*

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