Bayesian Hierarchical Model for Measuring Adoption Rates in South African Transport Maintenance Depot Systems

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Abstract

The adoption of advanced maintenance practices in South African transport systems is crucial for improving operational efficiency and safety. However, understanding the factors influencing these adoptions remains a challenge. Bayesian hierarchical models were employed to analyse data collected from multiple depots. The models account for both fixed effects (e.g., depot size, training programmes) and random effects (inter-depot variability). The analysis revealed a significant positive correlation between the number of maintenance personnel trained and the adoption rate of new technologies. Bayesian hierarchical models provide a robust framework for assessing and predicting adoptions in complex systems, offering insights into which factors are most influential. Further research should explore the long-term impacts of adopting these technologies and their economic benefits within South African transportation sectors. transport maintenance, adoption rates, Bayesian hierarchical models, South Africa, engineering The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

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