African Power Engineering

Bayesian Hierarchical Model for Yield Improvement in South African Transport Maintenance Depots Systems

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Abstract

Transport maintenance depots in South Africa face challenges in optimising their operations to improve efficiency and yield. The study employs a Bayesian hierarchical regression model to analyse data from multiple depots, incorporating spatial and temporal variability. Uncertainty is quantified using posterior credible intervals. A significant direction in the modelled yield across depots was an increase of up to 15% with specific patterns emerging in urban versus rural settings. The Bayesian hierarchical model effectively captures the complex interdependencies within and between depots, providing actionable insights for system optimization. Deploying the model across all depots could lead to substantial yield improvements and operational efficiencies. Bayesian Hierarchical Model, Transport Maintenance Depots, Yield Improvement, South Africa The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *African Geography, Hierarchical Modelling, Bayesian Statistics, Regression Analysis, Quality Improvement, Maintenance Systems, Econometrics*

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