African Renewable Energy Engineering

Methodological Evaluation of Transport Maintenance Depot Systems in Ethiopia Using Bayesian Hierarchical Models for Reliability Measurement

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Abstract

Transport maintenance depots in Ethiopia are critical for ensuring vehicle reliability and reducing downtime. However, their performance is often under-researched. A Bayesian hierarchical model was developed to analyse data from Ethiopian depots, accounting for variability across different depots and vehicle types. The analysis identified a cluster of depots with significantly higher reliability scores compared to others, suggesting targeted interventions are needed. Bayesian hierarchical models provide a robust method for assessing system reliability in complex maintenance environments. Implementing targeted improvement strategies based on the findings could lead to more efficient and reliable vehicle operations. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Bayesian hierarchical models, reliability measurement, maintenance systems, geographic information systems, stochastic processes, predictive analytics*

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