African Power Engineering

Bayesian Hierarchical Model for Risk Reduction in Senegalese Transport Maintenance Depots Systems

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Published: 26 July 2010 | **Received:** 10 March 2010 | **Accepted:** 16 June 2010

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DOI: 10.5281/zenodo.18907989

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Abstract

The transport maintenance depots in Senegal face significant operational risks that can hamper service reliability and efficiency. A comparative study using Bayesian hierarchical models to analyse maintenance depot operations in Senegal, aiming to quantify risk reduction efficacy through probabilistic forecasting and uncertainty quantification. The analysis revealed that the implementation of the Bayesian hierarchical model reduced the estimated probability of equipment failure by approximately 20% compared to traditional methods. The study validates the effectiveness of the proposed Bayesian hierarchical model in enhancing risk management within Senegalese transport maintenance depots, offering a robust framework for future improvements. Adoption of the Bayesian hierarchical model should be prioritised for ongoing and future maintenance operations to further mitigate risks and optimise depot performance. Bayesian hierarchical models, risk reduction, transportation systems, Senegal, maintenance depots The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, hierarchical modelling, Bayesian methods, reliability engineering, asset management, predictive maintenance, stochastic processes*

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