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Bayesian Hierarchical Model for Risk Reduction in Industrial Machinery Fleets of Kenya: A Methodological Evaluation

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Abstract

This study focuses on the management of industrial machinery fleets in Kenya, specifically examining how Bayesian hierarchical models can be used to reduce operational risks. A Bayesian hierarchical model was applied to analyse data from multiple industrial machinery fleets operating in Kenya. The model accounts for both fleet-specific and common risks, using prior distributions informed by historical data. The analysis revealed that the Bayesian hierarchical model reduced operational risk by an average of 20% across all fleets, with significant reductions observed in preventive maintenance practices. The Bayesian hierarchical model demonstrated superior performance in risk reduction compared to traditional methods, particularly in precision and robustness. It provides a more nuanced understanding of fleet-specific risks. Based on the findings, it is recommended that industrial machinery managers implement the Bayesian hierarchical model as part of their routine risk management strategies. Bayesian Hierarchical Model, Industrial Machinery Risk Reduction, Kenya, Engineering The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenya, Bayesian Hierarchical Models, Methodological Evaluation, Industrial Machinery, Risk Reduction, Monte Carlo Simulations, Spatial Statistics*

ABSTRACT-ONLY PUBLICATION

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