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Bayesian Hierarchical Model for Cost-Effectiveness Analysis of Industrial Machinery Fleets in Ethiopian Industries

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Abstract

Industrial machinery fleets play a crucial role in Ethiopian industries, impacting productivity, efficiency, and cost-effectiveness. However, existing studies often lack comprehensive methodologies for evaluating these systems. A Bayesian hierarchical model will be employed to analyse data on machinery usage, maintenance records, and operational costs across different industries in Ethiopia. This approach accounts for the variability between industries while allowing for shared parameters among them. The analysis revealed significant differences in cost-effectiveness metrics across industry sectors, with manufacturing showing higher efficiency compared to agriculture, indicating a need for tailored strategies. This study demonstrates the effectiveness of Bayesian hierarchical models in evaluating industrial machinery fleets and highlights the importance of sector-specific approaches. Stakeholders are recommended to implement targeted interventions based on findings from this model to enhance overall fleet performance and cost-effectiveness. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Bayesian statistics, hierarchical modelling, cost-effectiveness analysis, industrial economics, econometrics, stochastic processes, geographic information systems*

ABSTRACT-ONLY PUBLICATION

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