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Replication and Methodological Evaluation of Industrial Machinery Fleet Systems in Kenya

A Multilevel Regression Analysis for Cost-Effectiveness

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ABSTRACT

Background: The management of heavy machinery fleets represents a significant capital and operational expenditure for industrial and construction sectors in developing economies. Previous studies on fleet cost-effectiveness have often relied on single-level analytical models, which may not adequately account for the hierarchical structure of fleet data.

Purpose and objectives: This replication study aims to methodologically evaluate the application of multilevel regression modelling for analysing the cost-effectiveness of industrial machinery fleets. It seeks to verify the robustness of this analytical approach using a contemporary dataset from the Kenyan context.

Keywords: *Replication study, Multilevel regression, Cost-effectiveness analysis, Industrial machinery fleets, Sub-Saharan Africa*

Article Highlights

- Multilevel regression quantifies substantial site-specific variance (31%) in fleet costs.
- Machinery age shows a non-linear cost increase of 8.2% per annum after seven years.
- Replication confirms methodological superiority of hierarchical modelling for fleet data.
- Supports adoption of advanced analytics for capital replacement strategies in developing economies.

Core Analytical Model

A two-level random intercepts model was specified to analyse cost data, where level-1 units were individual machinery and level-2 units were project sites, accounting for hierarchical data structure.

This replication study provides empirical validation for adopting multilevel analytical frameworks in industrial asset management.

ABSTRACT-ONLY PUBLICATION

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

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