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A Multilevel Regression Analysis for Cost-Effectiveness in Ethiopian Industrial Machinery Fleet Management Systems

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ABSTRACT

Background: Industrial machinery fleet management is a critical operational and financial component for capital-intensive industries in developing economies. Inefficiencies in these systems lead to substantial cost overruns and project delays, yet there is a paucity of robust, quantitative frameworks for evaluating their cost-effectiveness in such contexts.

Purpose and objectives: This study aims to develop and apply a novel multilevel modelling framework to quantify the cost-effectiveness of industrial machinery fleet management systems, identifying key operational and organisational determinants of financial performance.

Keywords: *Fleet management systems, Multilevel modelling, Cost-effectiveness analysis, Industrial machinery, Sub-Saharan Africa, Developing economies, Regression analysis*

Article Highlights

- Multilevel modelling isolates company-level policies as the primary cost driver.
- Preventive maintenance compliance linked to 12.4% reduction in operating costs.
- Provides a superior analytical framework versus conventional single-level regression.
- Offers a quantitative benchmark for fleet management in developing economies.

Methodological Insight

A three-level linear mixed model (company, site, machine) was fitted to partition cost variance, using robust standard errors for inference on a cross-sectional dataset from Ethiopian industrial sites.

This study presents a novel analytical framework for asset management in capital-intensive industries.

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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