

Methodological Evaluation and Panel-Data Estimation of Cost-Effectiveness in Kenya's Industrial Machinery Fleets (2000–2026)

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ABSTRACT

Background: The operational efficiency of heavy industrial machinery is a critical determinant of capital project viability and national infrastructure development. In many developing economies, systematic, longitudinal analysis of fleet cost-effectiveness is lacking, leading to suboptimal asset management and procurement strategies.

Purpose and objectives: This study aims to develop and apply a robust panel-data econometric framework to evaluate the cost-effectiveness of industrial machinery fleets. The primary objective is to identify the key operational and maintenance drivers of total cost of ownership and to generate predictive insights for fleet management.

Keywords: *Panel-data econometrics, Cost-effectiveness analysis, Industrial machinery fleets, Sub-Saharan Africa, Maintenance optimisation, Capital project management, Developing economies*

Article Highlights

- Fixed-effects model explains 74% of variation in machinery hourly costs.
- Machine age shows non-linear cost relationship, with inflection after year eight.
- Proactive maintenance outweighs purchase price in long-term cost-effectiveness.
- Framework enables shift from descriptive to predictive fleet management.

Core Econometric Model

$$C_{it} = \alpha_i + \beta_1 U_{it} + \beta_2 A_{it} + \beta_3 M_{it} + \epsilon_{it}$$
, where C is total cost per hour, U is utilisation, A is age, and M is maintenance intensity.

This study provides a replicable framework for data-driven capital asset management in developing economies.

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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