

A Multilevel Regression Analysis for Reliability Diagnostics in Kenya's Industrial Machinery Fleets

A Policy Evaluation

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ABSTRACT

Background: Industrial machinery fleets are critical to national productivity, yet systemic reliability data in developing economies is sparse. In Kenya, frequent breakdowns and maintenance inefficiencies pose significant economic and safety risks, highlighting a need for robust diagnostic frameworks to inform maintenance and procurement policy.

Purpose and objectives: This policy analysis evaluates the application of multilevel regression modelling as a diagnostic tool for assessing the reliability of industrial machinery fleets. It aims to determine key predictors of failure and to propose a data-driven framework for national maintenance policy.

Keywords: *Industrial machinery reliability, Multilevel regression analysis, Maintenance policy evaluation, Sub-Saharan Africa, Kenya, Fleet management, Reliability diagnostics*

Article Highlights

- Multilevel regression quantifies variance at firm and sector levels, moving beyond aggregate failure rates.
- Machinery age shows a non-linear relationship with failure likelihood, with effects diminishing after a threshold.
- Operational environment factors, like dust exposure, were stronger predictors than maintenance spend alone.
- The analysis proposes a data-driven framework to inform national maintenance and procurement policy.

Methodological Insight

The study employed a multilevel regression model nesting machinery units within firms and sectors to partition variance and identify key predictors of failure.

This analysis provides a diagnostic framework to transform fleet management policy in developing industrial 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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