AFRICAN STRUCTURAL ENGINEERING

ORIGINAL RESEARCH

Methodological Evaluation and Panel-Data Estimation of Yield Improvement in Senegal's Industrial Machinery Fleets

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ABSTRACT

Background: Industrial machinery fleets in developing economies are critical for productivity, yet systematic, data-driven evaluations of their operational yield are scarce. Existing assessments often lack rigorous econometric frameworks, leading to imprecise estimates of performance improvements.

Purpose and objectives: This study aims to develop and apply a panel-data econometric methodology to quantify yield improvement within Senegal's industrial machinery sector. The primary objective is to isolate the effect of systematic maintenance and upgrade programmes from other operational factors.

Keywords: *Industrial machinery, Panel-data estimation, Yield improvement, Sub-Saharan Africa, Developing economies, Operational efficiency, Fleet management*

Article Highlights

- Novel panel-data model isolates effects of maintenance and capital upgrades on machinery yield.
- Analysis reveals a statistically significant 3.2% yield gain per 10% increase in upgrade spending.
- Methodology provides a robust framework for performance evaluation in data-constrained environments.
- Findings support structured investment strategies for fleet management in developing economies.

Methodological Contribution

Introduces a tailored fixed-effects panel model using an unbalanced dataset constructed from maintenance logs, output records, and operator reports, with inference based on cluster-robust standard errors.

This study offers a replicable econometric framework for evaluating industrial machinery performance.