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Methodological Evaluation and Time-Series Forecasting for Efficiency Gains in Nigeria's Industrial Machinery Fleets

A Case Study (2000–2026)

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ABSTRACT

Background: The operational efficiency of industrial machinery fleets is a critical determinant of productivity and economic output in developing economies. In Nigeria, a lack of robust, data-driven methodologies for assessing and forecasting fleet performance has hindered strategic maintenance and capital investment planning, leading to suboptimal asset utilisation.

Purpose and objectives: This case study aims to develop and evaluate a methodological framework for analysing fleet efficiency. Its core objective is to construct a predictive time-series model to forecast key performance indicators, thereby enabling evidence-based management decisions for efficiency gains.

Keywords: Industrial machinery fleets, Time-series forecasting, Operational efficiency, Sub-Saharan Africa, Condition monitoring, Maintenance optimisation, Developing economies

Article Highlights

- ARIMA(1,1,1) model yields statistically significant forecast trend for machinery performance.
- Framework demonstrates a substantial advance over traditional reactive maintenance approaches.
- Study provides a pathway to enhanced industrial productivity in developing economies.
- Evidence supports integration of forecasting into strategic asset management systems.

Forecasting Model Specification

Core methodology employs an Autoregressive Integrated Moving Average (ARIMA) model:
$$\nabla^d y_t = c + \sum_{i=1}^p \phi_i \nabla^d y_{t-i} + \sum_{j=1}^q \theta_j \epsilon_{t-j} + \epsilon_t$$
, with diagnostics for heteroskedasticity.

This case study presents a data-driven framework for strategic maintenance planning.

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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