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Methodological Framework for Time-Series Forecasting of Industrial Machinery Fleet Yield in Ghana, 2000–2026

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ABSTRACT

Background: The sustainable management of industrial machinery fleets is critical for national infrastructure development, yet a persistent gap exists in robust, data-driven methodologies for forecasting long-term yield in emerging economies. Existing approaches often lack the temporal granularity and contextual adaptation required for accurate planning in such settings.

Purpose and objectives: This article presents a novel methodological framework for time-series forecasting of industrial machinery fleet yield. Its primary objective is to provide a replicable, statistically rigorous model for measuring and projecting yield improvement, thereby supporting strategic asset management and capital investment decisions.

Keywords: *Time-series forecasting, Industrial machinery fleets, Yield improvement, Sub-Saharan Africa, Methodological framework, Predictive maintenance, Data-driven methodology*

Article Highlights

- Integrates ARIMAX modelling with exogenous economic variables for contextual adaptation.
- Provides a replicable, statistically rigorous model for long-term yield projection.
- Designed specifically for industrial asset management in emerging market settings.
- Supports strategic capital investment decisions through data-driven forecasting.

Core Forecasting Equation

The methodology employs $Y_t = \mu + \sum_{i=1}^{p}\phi_i Y_{t-i} + \sum_{j=1}^{q}\theta_j \epsilon_{t-j} + \sum_{k=1}^{m}\beta_k X_{k,t} + \epsilon_t$, where Y_t represents the yield metric, with parameters estimated via maximum likelihood.

This article presents a methodological framework without empirical results.