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# A Time-Series Forecasting Model for Yield Improvement in Nigeria's Industrial Machinery Fleets

*A Policy Analysis for Strategic Maintenance Optimisation*

**Chinweike Okonkwo**[1,2] | **Amina Suleiman-Bello**[2,3]

*Department of Sustainable Systems, Obafemi Awolowo University, Ile-Ife* • *Ladoke Akintola University of Technology (LAUTECH), Ogbomoso* • *Department of Civil Engineering, Obafemi Awolowo University, Ile-Ife*

**Correspondence:** cokonkwo@outlook.com

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## ABSTRACT

{ "background": "Persistent low yield from industrial machinery fleets in Nigeria's manufacturing and construction sectors represents a critical constraint on economic development. Current maintenance policies are largely reactive, leading to excessive downtime and capital inefficiency. A shift towards predictive, data-driven policy is required.", "purpose and objectives": "This policy analysis evaluates a novel time-series forecasting model designed to measure and improve machinery yield. The objective is to provide a methodological framework for strategic maintenance optimisation, enabling evidence-based policy formulation for fleet management.", "methodology": "The analysis employs a Seasonal Autoregressive Integrated Moving Average (SARIMA) model, formalised as $\varphi(B)\varphi(B^s)nabla^d nabla^{Ds} Yt = \theta(B)\theta(B^s)\varepsilon_t$, applied to historical operational availability and output data from a representative sample of machinery fleets. Model diagnostics include analysis of robust standard errors to assess parameter stability.", "findings": "The forecasting model demonstrates a statistically significant predictive capability for machinery failure windows, with a lead time sufficient for proactive intervention. Application of the model to simulated policy scenarios indicates a potential yield improvement of 18-24% through optimised maintenance scheduling, contingent on data quality and institutional adoption.", "conclusion": "The integration of time-series forecasting into maintenance policy presents a viable pathway for substantial yield gains. The model provides a quantitative basis for moving beyond schedule-based maintenance regimes, though its efficacy is dependent on systematic data collection and workforce upskilling.", "recommendations": "Policymakers should mandate the standardised collection of machinery performance data. A pilot programme for model implementation in state-owned enterprises is advised. Investment in training for predictive maintenance analytics is essential for long-term sustainability.", "key words": "Predictive maintenance, SARIMA modelling, industrial policy, asset management, operational research", "contribution statement": "This paper provides the first applied framework integrating SARIMA forecasting directly into national industrial maintenance policy for Nigeria, demonstrating a concrete methodology to translate operational data into

**Keywords:** *Industrial machinery fleets, Yield improvement, Time-series forecasting, Strategic maintenance optimisation, Sub-Saharan Africa, Policy analysis, Nigeria*

### Article Highlights

- SARIMA model provides statistically significant predictive capability for machinery failure windows.
- Shift from reactive to predictive maintenance enables evidence-based policy formulation.
- Yield improvement contingent on systematic data collection

### Policy Imperative

Mandate standardised machinery performance data collection and invest in predictive maintenance analytics training for sustainable implementation.

*This analysis provides a concrete methodological framework for translating operational data into national industrial policy.*

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| and institutional adoption.<br>• Model offers quantitative basis for moving beyond schedule-based maintenance regimes. | |