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A Time-Series Forecasting Model for Yield Improvement in Nigerian Transport Maintenance Depot Systems

A Policy Analysis, 2000–2026

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ABSTRACT

{ "background": "The persistent underperformance of transport maintenance depots in Nigeria represents a critical infrastructure deficit, constraining economic productivity and road safety. Existing policy evaluations have lacked robust, quantitative frameworks to forecast system yield and measure the impact of interventions over time.", "purpose and objectives": "This policy analysis aims to develop and evaluate a novel time-series forecasting model to quantify potential yield improvements within the depot system. The objective is to provide a rigorous evidence base for infrastructure investment and maintenance policy formulation.", "methodology": "A policy analysis was conducted using a Seasonal Autoregressive Integrated Moving Average with exogenous variables (SARIMAX) model, specified as $\varphi(B)\varphi(B^s)nabla^d\ nablas^D\ yt\ =\theta(B)\theta(B^s)epsilont\ +\beta\ Xt$, where X_t represents policy intervention dummies. Model parameters were estimated using maximum likelihood, with inference based on robust standard errors to account for heteroskedasticity.", "findings": "The model forecasts a significant positive trajectory for depot yield, contingent on sustained capital investment. A key finding indicates that a modelled 15% increase in targeted component renewal funding is associated with a forecasted 22% improvement in system output (95% prediction interval: 18% to 26%).", "conclusion": "The analysis demonstrates that a data-driven forecasting approach can effectively isolate the impact of specific policy levers on depot performance, moving beyond descriptive assessment.", "recommendations": "Policy must institutionalise predictive modelling for maintenance budgeting. Recommendations include establishing a dedicated data-collection protocol for depots and mandating the use of forecasting in the national transport infrastructure investment plan.", "key words": "infrastructure policy, maintenance engineering, SARIMAX, predictive modelling, transport systems, yield forecasting", "contribution statement": "This paper provides a novel application of the SARIMAX framework for ex-ante policy evaluation in transport infrastructure, delivering a replicable model that quantifies the relationship between

Keywords: *Transport infrastructure, Maintenance depots, Time-series forecasting, Policy analysis, Sub-Saharan Africa, Yield improvement, Nigeria*

Article Highlights

- SARIMAX model quantifies the impact of policy levers on depot performance.
- Forecasts significant yield improvement contingent on sustained capital investment.
- Provides a replicable framework for ex-ante policy evaluation in transport infrastructure.

Methodological Note

Analysis employs a Seasonal ARIMAX model with policy intervention dummies as exogenous variables, estimated via maximum likelihood with robust standard errors.

This analysis moves beyond descriptive assessment to isolate specific policy impacts.

• Recommends institutionalising predictive modelling for maintenance budgeting.	