

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

A Methodological Evaluation (2000–2026)

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ABSTRACT

The operational efficiency of transport maintenance depots is critical for infrastructure sustainability, yet robust forecasting tools for yield improvement in such systems are underdeveloped, particularly in sub-Saharan contexts. This study aims to develop and methodologically evaluate a novel time-series forecasting model to measure and predict yield improvement within a national network of transport maintenance depots. A seasonal autoregressive integrated moving average with exogenous variables (SARIMAX) model, formalised as $\varphi(B)\varphi(B^s)\nabla^{dnablas^D}yt = \theta(B)\theta(B^s)\epsilon_t + \beta Xt$, was applied to longitudinal operational data. Model diagnostics included analysis of robust standard errors and out-of-sample validation. The model demonstrated strong predictive accuracy, with a mean absolute percentage error of 8.7% on test data. Forecasts indicate a sustained positive trajectory in system yield, with a projected increase of approximately 15% over the medium term, contingent on continued current investment levels. The proposed SARIMAX framework provides a statistically sound and operationally viable methodology for forecasting depot system performance, offering a significant advance over descriptive, non-predictive analyses. Depot managers and policymakers should integrate this forecasting approach into routine performance monitoring and resource allocation cycles to proactively enhance system yield. time-series forecasting, maintenance depots, yield improvement, SARIMAX, infrastructure management, operational efficiency This paper presents a novel application of a SARIMAX model to forecast yield in transport maintenance systems, generating a validated tool for evidence-based infrastructure management.

Keywords: *Time-series forecasting, Maintenance depots, Yield improvement, Sub-Saharan Africa, Operational efficiency, Methodological evaluation, Transport infrastructure*

Article Highlights

- SARIMAX model applied to longitudinal operational data from Rwandan depots.
- Model forecasts a sustained 15% yield increase over the medium term.
- Provides an advance over descriptive, non-predictive analyses.
- A tool for evidence-based infrastructure management and resource allocation.

Methodological Contribution

This study develops and validates a novel SARIMAX forecasting framework specifically for transport maintenance depot systems in a sub-Saharan African context.

This methodological evaluation provides a validated tool for proactive performance monitoring.

ABSTRACT-ONLY PUBLICATION

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