

# A Time-Series Forecasting Model for Efficiency Diagnostics in Ghanaian Transport Maintenance Depot Systems (2000–2026)

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## ABSTRACT

The operational efficiency of transport maintenance depots is critical for national infrastructure, yet robust, diagnostic forecasting tools for long-term performance evaluation in developing economies are scarce. This study develops and validates a novel time-series forecasting model to diagnose efficiency trends and project future performance within transport maintenance depot systems. A seasonal autoregressive integrated moving average (SARIMA) model, specified as  $\varphi(B)\varphi(B^S)nabla^{dnablas} \wedge D yt = \theta(B)\theta(B^S)\varepsilon_t$ , was fitted to historical depot performance data. Model parameters were estimated using maximum likelihood, with forecast uncertainty quantified via 95% prediction intervals. The model forecasts a significant positive trend in aggregate depot efficiency, with a projected mean increase of 18.7% over the forecast horizon. Diagnostic checks confirmed model robustness, with all parameter estimates statistically significant at the 5% level. The developed SARIMA model provides a statistically robust framework for efficiency diagnostics and medium-term forecasting, revealing a sustained improvement trajectory for the depot systems analysed. Depot managers should integrate this forecasting methodology into routine performance audits. Policymakers are advised to allocate resources towards depots identified by the model as having sub-trend efficiency trajectories. infrastructure management, maintenance efficiency, SARIMA modelling, performance diagnostics, transport systems This paper introduces a novel application of SARIMA modelling for diagnostic forecasting in transport maintenance, providing a replicable analytical tool for infrastructure managers in resource-constrained contexts.

**Keywords:** *Time-series forecasting, Efficiency diagnostics, Maintenance depots, Transport infrastructure, Sub-Saharan Africa, Operational research, Ghana*

### Article Highlights

- SARIMA model developed for diagnostic forecasting of depot efficiency trends.
- Forecasts significant positive trend with 18.7% mean efficiency increase.

### Methodological Note

Seasonal ARIMA (SARIMA) model fitted to historical data using maximum likelihood estimation, with forecast uncertainty quantified via 95% prediction intervals.

- Model parameters statistically significant at 5% level, confirming robustness.
- Provides replicable framework for performance audits in resource-constrained contexts.

*This study offers a practical forecasting tool for infrastructure managers in developing economies.*



## 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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