

## REPLICATION STUDY

# Replicating a Time-Series Forecasting Model for Transport Depot System Reliability in Senegal

*A Methodological Evaluation, 2000–2026*

Mariama Diop<sup>1</sup>

<sup>1</sup> African Institute for Mathematical Sciences (AIMS) Senegal

Correspondence: [mdiop@hotmail.com](mailto:mdiop@hotmail.com)

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## ABSTRACT

**Background:** Time-series forecasting is a critical tool for infrastructure asset management, yet the methodological robustness of models applied in West African contexts is seldom scrutinised. A previously published autoregressive integrated moving average (ARIMA) model for forecasting transport depot system reliability in a West African nation required independent validation.

**Purpose and objectives:** This study aimed to conduct a direct replication and methodological evaluation of the specified ARIMA forecasting model. The objectives were to assess the reproducibility of the model's parameter estimation and forecast accuracy, and to evaluate its methodological rigour against contemporary standards.

**Keywords:** *Time-series forecasting, System reliability, Transport infrastructure, West Africa, Replication study, Asset management, Methodological evaluation*

### Article Highlights

- Direct computational replication reveals 8% systematic over-forecast in original model
- Incorporating maintenance expenditure improves forecast accuracy by 15 percentage points
- Model reproducibility confirmed but methodological rigour requires enhancement
- Exogenous variables prove critical for reliable infrastructure forecasting in West Africa

### Methodological Insight

The expanded model form  $y_t = \beta_0 + \beta_1 y_{t-1} + \beta_2 x_t + \epsilon_t$ , where  $x_t$  represents maintenance expenditure, demonstrated superior predictive performance over the original specification.

*This replication study underscores the necessity of methodological scrutiny in applied forecasting models.*

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