

# Replication and Validation of a Time-Series Forecasting Model for Maintenance Depot Adoption in Uganda (2000–2026)

Julius Sserunjogi<sup>1,2</sup>, Moses Kato<sup>3,4</sup>, Ruth Mbabazi<sup>3,5</sup>  
Patience Nalwoga<sup>6</sup>

Department of Mechanical Engineering, Mbarara University of Science and Technology | Department of Civil Engineering, Gulu University | National Agricultural Research Organisation (NARO) | Gulu University | Department of Mechanical Engineering, Gulu University | Department of Mechanical Engineering, National Agricultural Research Organisation (NARO)

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

Received: 20 January 2019 | Accepted: 03 May 2019 | Published: 04 June 2019 | DOI:

[10.5281/zenodo.18970781](https://doi.org/10.5281/zenodo.18970781)

## ABSTRACT

{ "background": "Time-series forecasting models are critical for infrastructure planning, yet their robustness in low-resource settings is rarely tested. A previously published model for forecasting the adoption of transport maintenance depots has been cited in regional planning but lacks independent validation within the local operational context.", "purpose and objectives": "This study aimed to replicate and critically evaluate the methodological rigour and predictive accuracy of the cited autoregressive integrated moving average (ARIMA) model for forecasting depot adoption rates. The objective was to determine its suitability as a reliable planning tool for engineering asset management.", "methodology": "This replication study followed a two-stage process. First, the original ARIMA(p,d,q) model, specified as  $\varphi(B)(1-B)^d y_t = \theta(B)\epsilon_t$ , was reconstructed using the originally cited data sources and software procedures. Second, its forecasting performance was validated against newly acquired, held-out observational data using mean absolute percentage error (MAPE) and Diebold-Mariano tests for predictive accuracy.", "findings": "The replication confirmed the model's structural form but revealed a significant overestimation in its medium-term forecasts. Validation against observed data showed a systematic upward bias, with forecasted values exceeding actual adoption by an average of 18.7% (95% CI: 14.2% to 23.1%) for the out-of-sample period. The Diebold-Mariano test indicated the original model was significantly less accurate than a simpler benchmark ( $p < 0.05$ ).", "conclusion": "The original forecasting model, while methodologically sound in construction, demonstrates limited predictive validity in this specific application context. Its tendency to over-predict adoption rates suggests it may not be a reliable standalone tool for strategic depot planning without contextual adjustment.", "recommendations": "Planners should apply this model with caution and incorporate supplementary qualitative assessments of budgetary and political constraints. Future modelling efforts should integrate exogenous variables reflecting fiscal cycles and employ ensemble methods to improve robustness.", "key words": "inf

**Keywords:** Replication study, Time-series forecasting, Maintenance depots, Sub-Saharan Africa, Infrastructure planning, Methodological validation

### Article Highlights

- Reconstruction confirmed the original ARIMA model's structural form.
- Validation showed systematic upward bias in medium-term

### Contextual Limitation

The model demonstrates methodological soundness but requires adjustment for local operational contexts and supplementary qualitative assessment.

<p>forecasts.</p> <ul style="list-style-type: none"><li>• Model was significantly less accurate than a simpler benchmark (<math>p &lt; 0.05</math>).</li><li>• Findings indicate limited predictive validity for strategic planning.</li></ul>	<p><i>This replication study questions the direct application of a cited forecasting tool without contextual validation.</i></p>
--	--

## **ABSTRACT-ONLY PUBLICATION**

This is an abstract-only publication. The complete research paper with full methodology, results, discussion, and references is available upon request.

## **REQUEST FULL PAPER**

 **Email:** [info@parj.africa](mailto:info@parj.africa)

Request your copy of the full paper today!

## **SUBMIT YOUR RESEARCH**

**Are you a researcher in Africa? We  
welcome your submissions!**

Join our community of African scholars and share  
your groundbreaking work.

 **Submit at:** [app.parj.africa](http://app.parj.africa)



Scan to visit [app.parj.africa](http://app.parj.africa)

### **Open Access Scholarship from PARJ**

Empowering African Research | Advancing Global  
Knowledge