AFRICAN STRUCTURAL ENGINEERING

Replication and Validation of a Time-Series Forecasting Model for Process-Control System Efficiency in Ethiopia (2000–2026)

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ABSTRACT

Background: Time-series forecasting models for industrial process-control efficiency are critical for infrastructure planning in developing economies. A previously proposed model for predicting efficiency gains has been cited widely but lacks independent validation using local operational data.

Purpose and objectives: This study aims to replicate and critically evaluate the methodological robustness and predictive accuracy of the specified forecasting model within the context of a developing industrial sector. The objective is to determine its validity for long-term strategic planning.

Keywords: *Replication study, Time-series forecasting, Process-control systems, Sub-Saharan Africa, Model validation, Industrial efficiency*

Article Highlights

• Direct computational replication confirms model structure but reveals forecasting bias.
• Revised long-term trend parameter shows statistically significant downward revision.
• Unadjusted application may lead to substantial overinvestment in capacity planning.
• Study provides recalibrated framework for industrial forecasting in developing economies.

Methodological Note

The core ARIMA model was tested against a new high-resolution operational dataset using MAPE and Diebold-Mariano tests for forecasting accuracy.

This replication study provides critical parameter adjustments for infrastructure planning models.

📄 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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