AFRICAN STRUCTURAL ENGINEERING

ORIGINAL RESEARCH

Methodological Evaluation and Time-Series Forecasting for Yield Improvement in Rwandan Process-Control Systems

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ABSTRACT

Background: Process-control systems in industrial settings are critical for operational efficiency and product yield. In many developing economies, systematic evaluation of these systems and predictive modelling for yield optimisation are underdeveloped, leading to suboptimal performance and resource utilisation.

Purpose and objectives: This study aims to methodologically evaluate existing process-control frameworks and to develop a robust time-series forecasting model specifically for predicting and improving production yield in an industrial context.

Keywords: *Process-control systems, Time-series forecasting, Yield improvement, Sub-Saharan Africa, Industrial engineering, Methodological evaluation, Developing economies*

Article Highlights

- Diagnostic evaluation identified sensor-data feedback latency as a primary constraint.
- ARIMAX(2,1,1) model with exogenous variables demonstrated statistically significant forecasting capability.
- Framework combines control system diagnostics with tailored time-series forecasting.
- Model validation supports implementation in real-time monitoring dashboards.

Methodological Contribution

Presents a novel integrated framework combining control system diagnostics with a tailored ARIMAX forecasting model, specifically validated for Rwandan industrial contexts.

This study provides both diagnostic and predictive tools for yield optimisation in developing economy settings.