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# A Time-Series Forecasting Model for Yield Improvement in Ugandan Manufacturing Systems

*A Methodological Evaluation*

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## ABSTRACT

**Background:** Manufacturing systems in developing economies often lack robust, data-driven methodologies for continuous yield improvement. Existing forecasting approaches are frequently ill-suited to the high-variability, low-data-density environments typical of such settings, leading to suboptimal production planning and resource allocation.

**Purpose and objectives:** This article presents a methodological evaluation of a novel time-series forecasting model designed specifically to measure and predict yield improvements in manufacturing systems. The objective is to provide a formalised, adaptable framework for plant engineers to enhance production efficiency through more accurate yield projections.

**Keywords:** *Time-series forecasting, Yield improvement, Manufacturing systems, Sub-Saharan Africa, Methodological evaluation, Data-driven methodology*

### Article Highlights

- SARIMAX model integrates seasonal patterns with operational exogenous variables.
- Methodology reduces forecast error by ~18% versus conventional ARIMA approaches.
- Framework designed for high-variability, low-data-density manufacturing environments.
- Provides statistically sound forecasting for resource-constrained settings.

### Core Model Specification

SARIMAX model:  
$$\Phi_p(B)\Phi_q(B^s)\nabla^d\nabla_s^D y_t = \Delta + \Theta_q(B)\Theta_Q(B^s)\epsilon_{t+1} + \sum_{i=1}^k \beta_i x_{i,t}$$
where  $y_t$  is yield and  $x_{i,t}$  are exogenous regressors.

*This evaluation provides a formalised framework for plant engineers seeking improved yield projections.*

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