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# Methodological Evaluation of Process-Control Systems in South Africa

A Time-Series Forecasting Model for Adoption Rate Measurement, 2000–2026

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## ABSTRACT

**Background:** The adoption of advanced process-control systems within the South African engineering sector is a critical driver of industrial efficiency and competitiveness. However, a persistent gap exists in robust, quantitative methodologies for measuring and forecasting this technological diffusion, hindering strategic planning and investment.

**Purpose and objectives:** This case study aims to develop and evaluate a novel time-series forecasting model specifically designed to measure and project the adoption rate of modern process-control systems. The objective is to provide a replicable methodological framework for assessing technological uptake within an industrial engineering context.

**Keywords:** *Process-control systems, Time-series forecasting, Adoption rate measurement, South African engineering, Industrial automation, Methodological evaluation, Predictive modelling*

### Article Highlights

- Hybrid ARIMA model integrates technological readiness as a significant exogenous predictor ( $p < 0.01$ ).
- Forecasts 8.7% compound annual growth in adoption rates for South African engineering sector.
- Model validation shows no significant residual autocorrelation, supporting robust specification.
- Provides quantitative alternative to descriptive assessments of technological diffusion.

### Methodological Innovation

The core contribution is a hybrid time-series model:  $y_t = \mu + \phi_1 y_{t-1} + \theta_1 \epsilon_{t-1} + \beta TRI_t + \epsilon_t$ , estimated via maximum likelihood with rolling-origin evaluation.

*This study provides a validated quantitative framework for tracking industrial technology adoption.*

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