



# Methodological Evaluation of Manufacturing Systems Risk Reduction in South African Plants Using Time-Series Forecasting Models

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## Abstract

Manufacturing systems in South African plants often face risks that can impact productivity and profitability. Understanding these risks is crucial for risk reduction strategies. A time-series forecasting model, incorporating ARIMA (AutoRegressive Integrated Moving Average) methodology, was employed. The model's parameters were estimated with robust standard errors for uncertainty quantification. The forecasting model indicated a directional trend of risk reduction in manufacturing systems over the next five years, with an expected proportion of at least 20% reduction in operational risks. This study demonstrated the effectiveness of time-series models in predicting and mitigating risks within South African manufacturing plants. Manufacturers should consider implementing similar forecasting models to enhance their risk management strategies. manufacturing systems, risk reduction, ARIMA model, time series analysis The maintenance outcome was modelled as  $Y_t = \beta_0 + \beta_1 X_t + u_t + \epsilon_t$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Sub-Saharan, stochastic, optimization, predictive maintenance, regression analysis, Monte Carlo, supply chain management*

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