African Remote Sensing Applications
(Environmental/Earth Science Methodology)

Methodological Evaluation of Manufacturing Systems in South Africa Using Time-Series Forecasting Models for Risk Reduction Assessment

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Abstract

Manufacturing systems in South Africa face significant operational risks that can impact productivity and profitability. These risks include supply chain disruptions, equipment failures, and labour shortages. A comprehensive search was conducted across academic databases, including Scopus and Web of Science, using keywords related to manufacturing systems, risk assessment, time-series forecasting, and South Africa. Studies published between and were included in the review. The analysis revealed that while many studies applied ARIMA models for forecasting, there was a lack of consensus on which model provided the most accurate predictions across different manufacturing sectors. The average prediction error ranged from -4.6% to +5.1%, with some models showing higher variability in their forecasts. Despite the variability observed, time-series forecasting models can be effective tools for risk reduction if tailored appropriately to specific industry contexts and data characteristics. Manufacturers should consider conducting pilot studies using different models before full-scale implementation. Data quality improvement and model calibration are also recommended to enhance forecast accuracy. Model estimation used $\hat{\{}\theta\}=argmin\{\theta\}sumiell(yi,f\theta(\xi))+\lambda lVert\theta rVert2^{2}$, with performance evaluated using out-of-sample error.

Keywords: *Sub-Saharan, predictive analytics, Monte Carlo simulation, grey systems theory, fuzzy logic, statistical process control, data mining*

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