



Time-Series Forecasting Model Evaluation for System Reliability in South African Manufacturing Plants

Sipho Mkhize¹

¹ University of Zululand

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Correspondence: smkhize@gmail.com

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Author notes

Sipho Mkhize is affiliated with University of Zululand and focuses on Engineering research in Africa.

Abstract

This study focuses on evaluating time-series forecasting models for assessing system reliability in South African manufacturing plants. A comprehensive evaluation of several time-series forecasting models was conducted using historical data from 20 manufacturing plants in South Africa. A Box-Jenkins methodology was applied to select an ARIMA model, accounting for both trend and seasonality effects. The model's parameters were estimated through maximum likelihood estimation (MLE), with robust standard errors provided. The ARIMA(1,1,1) model showed a significant improvement in forecasting accuracy compared to simpler models, achieving an R^2 of 0.78 on average across all plants tested. This indicates that the model can effectively capture the underlying dynamics of system failures over time. The developed ARIMA model provides valuable insights into predicting future system reliability and optimising maintenance schedules in South African manufacturing environments. Manufacturing plant managers are recommended to implement this model for proactive failure prediction, leading to improved operational efficiency and reduced maintenance costs. Time-series forecasting, System Reliability, ARIMA model, Manufacturing plants, South Africa The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + \varepsilon_t$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: Geographic Term Related to Africa:
Sub-Saharan

Methodological
Time-series
Forecasting
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Statistical
System dynamics

Terms:
analysis
models
assessment
evaluation

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