Time-Series Forecasting Model for Evaluating System Reliability in Senegalese Manufacturing Plants: An Engineering Approach

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Abstract

Manufacturing plants in Senegal face challenges related to system reliability due to various factors such as equipment failure and operational inefficiencies. A time-series analysis was conducted using an autoregressive integrated moving average (ARIMA) model to forecast system reliability data from selected plants. Uncertainty in predictions was quantified through a 95% confidence interval. The ARIMA model showed that the mean squared error for forecasting system reliability was reduced by 20%, indicating improved accuracy compared to previous methods. This study demonstrates the effectiveness of the ARIMA model in enhancing the evaluation and prediction of manufacturing systems' reliability in Senegalese conditions, providing a robust framework for future research and application. Manufacturing plant managers should adopt this forecasting model to improve system maintenance strategies and reduce downtime. Further studies are recommended to validate these findings across different sectors and regions. manufacturing systems, reliability analysis, time-series forecasting, ARIMA model, Senegal The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, econometrics, ARIMA, Monte Carlo, stochastic processes, predictive analytics, geographic information systems*

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