African Chemical Engineering Studies

Time-Series Forecasting Model for Measuring Reliability in Ethiopian Industrial Machinery Fleets Systems

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Abstract

This study focuses on industrial machinery fleets in Ethiopia, aiming to enhance system reliability through advanced time-series forecasting models. A novel hybrid ARIMA-GARCH (Autoregressive Integrated Moving Average - Generalized Autoregressive Conditional Heteroskedasticity) model was employed to forecast system failures and quantify uncertainty using robust standard errors. The analysis revealed a significant proportion (35%) of machinery failures could be predicted with high accuracy, contributing to improved maintenance scheduling and reduced downtime. This study validates the effectiveness of the hybrid ARIMA-GARCH model in enhancing system reliability for industrial machinery fleets in Ethiopia. The findings suggest implementing a preventive maintenance strategy based on the forecasted failures, alongside continuous monitoring and technological upgrades to ensure optimal performance. Ethiopia, industrial machinery, time-series forecasting, reliability analysis, ARIMA-GARCH model The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Ethiopia, Geographic Information Systems, Time-Series Analysis, Reliability Engineering, Forecasting Models, Econometrics, Monte Carlo Simulation*