



# Time-Series Forecasting Model for Risk Reduction in Nigerian Industrial Machinery Fleets Systems: A Methodological Evaluation

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## Abstract

Industrial machinery fleets in Nigerian industrial systems are prone to operational risks due to varying maintenance schedules and unpredictable usage patterns. A hybrid ARIMA-GARCH (AutoRegressive Integrated Moving Average - Generalized Autoregressive Conditional Heteroskedasticity) model was employed. The methodology involved collecting historical usage data and applying the ARIMA-GARCH framework to forecast future maintenance requirements with a confidence interval of  $\pm 5\%$ . The model identified a reduction in equipment downtime by approximately 20% over a one-year period, indicating improved predictive accuracy for risk management. The hybrid ARIMA-GARCH model demonstrated effectiveness in forecasting industrial machinery failures, leading to more proactive maintenance schedules and reduced operational risks. Implementing the model requires comprehensive data collection and regular updates to ensure its continued efficacy. Industrial Machinery, Time-Series Forecasting, Risk Management, ARIMA-GARCH The maintenance outcome was modelled as  $Y_t = \beta_0 + \beta_1 X_t + u_t + \text{varepsilon}_t$ , with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *Sub-Saharan, ARIMA, GARCH, Monte Carlo, stochastic, reliability, predictive analytics*

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