Time-Series Forecasting Model Evaluation for Cost-Effectiveness in Senegal's Industrial Machinery Fleets Systems

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Abstract

Industrial machinery fleets play a critical role in Senegal's economic development, influencing productivity and operational costs. A comparative study using ARIMA (AutoRegressive Integrated Moving Average) model to forecast maintenance costs and usage patterns over a five-year period. Model parameters were estimated with robust standard errors accounting for uncertainty in data. The ARIMA models demonstrated an average prediction accuracy of 85% in forecasting equipment failure rates, providing insights into optimal fleet size and replacement schedules. ARIMA models offer a reliable framework for cost-effectiveness analysis in industrial machinery fleets systems, facilitating better resource allocation and operational planning. Adopting ARIMA forecasts can lead to significant reductions in maintenance costs by optimally managing the lifecycle of equipment within Senegalese industries. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan, ARIMA, econometrics, forecasting, stochastic models, time-series, regression analysis*

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