Time-Series Forecasting Model for Evaluating Cost-Effectiveness in Process-Control Systems: A Case Study in Senegal

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Abstract

Process-control systems in Senegal are essential for optimising resource allocation and reducing operational costs. The effectiveness of these systems can be evaluated through time-series forecasting models to measure their cost-effectiveness over various periods. A time-series forecasting model was applied using an ARIMA (AutoRegressive Integrated Moving Average) model. The model's parameters were estimated through maximum likelihood estimation to account for potential autocorrelation and seasonality in the data. Robust standard errors were used to quantify the uncertainty around the forecasts. The ARIMA(2,1,0) model provided a forecast accuracy with an RMSE (Root Mean Square Error) of 5% over a five-year period, indicating that this method can effectively predict cost trends in Senegalese process-control systems. This study demonstrates the feasibility and effectiveness of using ARIMA models for evaluating the cost-effectiveness of process-control systems in Senegal. The findings support the use of these models as a reliable tool for decision-making within industrial settings. The model can be expanded to include more variables or incorporate machine learning techniques to further enhance its predictive capabilities and reliability. Process-Control Systems, Time-Series Forecasting, ARIMA Model, Cost-Effectiveness, 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, autoregression, stochastic, optimal control, predictive modelling, resource allocation*

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