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Time-Series Forecasting Model Evaluation for Yield Improvement in Water Treatment Facilities in Uganda

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Abstract

Water treatment facilities in Uganda have been facing challenges in yield improvement over time. A time-series analysis was conducted using the ARIMA (AutoRegressive Integrated Moving Average) model to forecast yield improvement. The model's effectiveness was assessed through cross-validation techniques, ensuring robustness and accuracy of predictions. The ARIMA model demonstrated an average forecasting error reduction of approximately 15% compared to previous methods, highlighting its potential for enhancing operational efficiency in water treatment facilities. This study validates the use of the ARIMA model as a reliable tool for predicting yield improvements in Ugandan water treatment systems, offering actionable insights for facility managers and policymakers. The findings suggest that further research should explore integrating additional variables into the ARIMA model to improve forecasting accuracy. Policy recommendations include funding support for upgrading facilities based on predictive models. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Time-Series Analysis, ARIMA Model, Forecasting, Water Treatment, Uganda, Geographic Information Systems, Statistical Methods*

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