# Time-Series Forecasting Model Evaluation of Water Treatment Facilities in Senegal: A Cost-Effectiveness Analysis

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## Abstract

Water treatment facilities in Senegal are critical for ensuring safe drinking water and sanitation services across the country. However, their effectiveness varies over time, necessitating a systematic evaluation to optimise resource allocation. A time-series forecasting model was developed using historical data from water treatment plants in Senegal, including parameters such as inflow volume, treatment process efficiency, and operational costs. Robust standard errors were used for the statistical analysis to account for uncertainties in input variables. The forecast model identified a significant decline in effluent quality over time, which correlated with increased operational costs despite consistent funding levels. This trend suggests that current facilities may not be sustainable without substantial upgrades or alternative strategies. This study provides a novel method for evaluating the cost-effectiveness of water treatment facilities by integrating historical data and forecasting models, offering insights into potential improvements in Senegal's water infrastructure. Based on the findings, it is recommended that policymakers consider implementing preventive maintenance programmes to mitigate future declines in effluent quality and explore partnerships with private sector entities for more efficient service delivery. The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

**Keywords:** *African Geography, Time-Series Analysis, Econometrics, Water Resource Management, Cost-Benefit Analysis, System Dynamics, Stochastic Modelling*

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