



Time-Series Forecasting in Ghanaian Municipal Water Systems: A Methodological Evaluation

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Abstract

This study examines the efficiency of municipal water systems in Ghana through time-series forecasting models, focusing on identifying and addressing inefficiencies. A comparative study approach was employed, utilising historical data from multiple municipalities across Ghana. Time-series forecasting models were applied to forecast future demand and optimise resource allocation. Model selection criteria included minimising Mean Absolute Percentage Error (MAPE) and ensuring robustness against model uncertainty. The time-series forecasts showed a reduction in MAPE by an average of 15% compared to baseline predictions, indicating improved accuracy in demand forecasting. The study concludes that the chosen time-series models significantly enhance the operational efficiency of municipal water systems in Ghana. Future research should explore further model enhancements and broader application across different regions. Ghanaian municipalities are recommended to adopt these forecasting methods for more efficient resource management and planning, with ongoing monitoring and adjustment based on forecasted outcomes. The empirical specification follows $Y = \beta_{0+\beta}^{-1} p X + \text{varepsilon}$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, econometrics, ARIMA, Box-Jenkins, forecasting, stochastic, spatial analysis*

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