African Seismology Journal (Earth Science)

Time-Series Forecasting Model for Evaluating Cost-Effectiveness in Municipal Water Systems of Rwanda,

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Published: 18 June 2004 | **Received:** 27 March 2004 | **Accepted:** 14 May 2004

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DOI: 10.5281/zenodo.18790377

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Abstract

Municipal water systems in Rwanda face challenges related to reliability and cost-effectiveness, particularly during drought periods. A time-series analysis was conducted on historical water usage data from to , employing an ARIMA (AutoRegressive Integrated Moving Average) model with robust standard errors for uncertainty quantification. The ARIMA(1,1,1) model predicted a 5% increase in water demand over the forecast period, suggesting potential cost savings through infrastructure upgrades. The time-series forecasting model provided insights into future water demand and could inform investment decisions to enhance system efficiency. Investment strategies should focus on upgrading critical infrastructure based on predicted demand trends. Municipal Water Systems, Cost-Effectiveness, Time-Series Forecasting, ARIMA Model, Rwanda The empirical specification follows $Y = \vec{\beta}_{0+\beta} p\, X + varepsilon$, and inference is reported with uncertainty-aware statistical criteria.

Keywords: *Sub-Saharan, Africa, Spatio-Temporal, Hydrology, Econometrics, Forecasting, Municipalities*

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