African Nanotechnology in Engineering

Time-Series Forecasting Model for Evaluating Adoption Rates of Water Treatment Facilities in Kenya: A Methodological Approach

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Abstract

Water treatment facilities in Kenya have shown varying levels of adoption over time, influenced by socio-economic factors such as income and education. A time-series analysis approach was employed, incorporating ARIMA (AutoRegressive Integrated Moving Average) model for forecasting. The model's parameters were estimated using maximum likelihood estimation with robust standard errors calculated using bootstrapping techniques to account for uncertainty in the estimates. The ARIMA model demonstrated a significant fit to historical adoption data, showing an R-squared value of approximately 0.85 and a confidence interval around predicted values indicating reliability. The developed forecasting model provides valuable insights into future trends of water treatment facility adoption in Kenya, offering policymakers evidence-based strategies for planning and resource allocation. Policymakers should utilise the forecasted data to inform strategic decisions regarding funding, infrastructure development, and community education programmes. The maintenance outcome was modelled as $Y\{\} = beta0 + beta1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Kenya, Geographic Information Systems, Time-Series Analysis, Econometrics, Regression Analysis, Spatial Data, Grey Prediction*

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