



Time-Series Forecasting Model Evaluation for Cost-Effectiveness Assessment of Municipal Infrastructure Assets in Rwanda

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Abstract

The management of municipal infrastructure assets in Rwanda is crucial for urban development and public service delivery. However, accurate forecasting models are essential to assess cost-effectiveness over time. A comprehensive analysis was conducted using historical data on municipal infrastructure expenditures and operational costs. A Box-Jenkins ARIMA (AutoRegressive Integrated Moving Average) model was applied to forecast future asset performance. The ARIMA(2,1,0) model showed a significant fit with the actual expenditure data, explaining 85% of the variance in monthly expenditures over a five-year period. The time-series forecasting model demonstrates high predictive accuracy and reliability for cost-effectiveness assessments in municipal infrastructure management. Implementing this model can aid policymakers in making informed decisions regarding future investments and resource allocation. Municipal Infrastructure, Cost-Effectiveness, Time-Series Forecasting, ARIMA Model, Expenditure Forecasting The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + v_{\epsilon_t}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Sub-Saharan Africa, Geographic Information Systems (GIS), Monte Carlo simulation, Grey system theory, Econometrics, Predictive analytics, Critical infrastructure assessment*

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