



Forecasting Municipal Infrastructure Risk Reduction in Nigeria Using Time-Series Models

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Abstract

Urban infrastructure in Nigeria is under significant stress due to rapid urbanization and inadequate maintenance, leading to frequent failures of critical municipal assets such as water supply systems, sewage networks, and stormwater drainage facilities. Time-series analysis was employed, including autoregressive integrated moving average (ARIMA) models, to forecast municipal infrastructure risk reduction in Nigeria. Data from the Nigerian Water Resources Agency were analysed over a decade to establish trends and patterns indicative of asset health and failure risks. The ARIMA model demonstrated an R^2 value of 0.85 for predicting future failures within the next five years, indicating that the model is highly effective in forecasting risk reduction with a confidence interval of $\pm 3\%$. This study validates the use of time-series models as a reliable tool for municipal infrastructure asset management and risk mitigation in Nigeria. Based on the findings, municipalities should prioritise maintenance programmes and allocate resources to critical assets identified by the predictive model. Additionally, regular data collection and updates are recommended to ensure model accuracy and relevance. The maintenance outcome was modelled as $Y_t = \beta_0 + \beta_1 X_t + u_t + \epsilon_t$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Nigerian, Urbanization, Infrastructure, Risk Management, Time-Series Analysis, Forecasting, Modelling*

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