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Methodological Evaluation of Municipal Infrastructure Assets Systems Using Time-Series Forecasting in Nigeria: A Risk Reduction Approach

Chinwe Oziaya[1]

[1] Ladoke Akintola University of Technology (LAUTECH), Ogbomoso

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Correspondence: coziaya@gmail.com

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Author notes

Chinwe Oziaya is affiliated with Ladoke Akintola University of Technology (LAUTECH), Ogbomoso and focuses on Engineering research in Africa.

Abstract

Municipal infrastructure assets in Nigeria are critical for economic development but face significant risks due to aging structures and inadequate maintenance. A comprehensive methodological approach was employed, including data collection from multiple sources, application of a SARIMA (Seasonal AutoRegressive Integrated Moving Average) model for forecasting future maintenance needs and risks, with robust uncertainty estimation provided by bootstrapping techniques. The analysis revealed that the proportion of assets requiring urgent attention increased by approximately 15% over a five-year period, highlighting the need for improved predictive models to mitigate these risks effectively. This study underscores the importance of adopting advanced forecasting methodologies in municipal infrastructure management to enhance risk reduction and ensure sustainable development. Immediate investment in maintenance programmes and adoption of more sophisticated forecasting tools are recommended based on this analysis. Municipal Infrastructure, SARIMA Model, Risk Reduction, Time-Series Forecasting The maintenance outcome was modelled as $Y\{\} = beta\,0 + beta\,1\,X\{\} + ui + varepsilon\{\}$, with robustness checked using heteroskedasticity-consistent errors.

Keywords: *Geographic, African, Infrastructure, Asset Management, Time-Series, Forecasting, Risk Analysis*

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